December 1980
vol 6, no 12
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creative computing

#1 magazine of computer applications and software

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Nuclear Power Plant Simulation

Alvin Toffler: The Electronic Cottage

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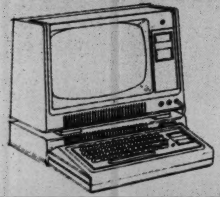
TRS-80* Model I Computer Owners . . .



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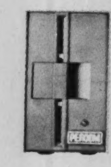

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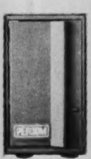

TFD-100 drives are "flippy" drives. You store twice the data per minidiskette by using both sides of the disk. TFD-100 drives store 180 Kbytes (double-density) or 102 Kbytes (single-density) **per side.** Under double-density operation, you can store a 70-page document on one minidiskette.

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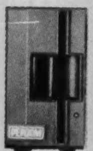
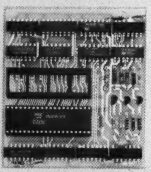


TFD-200 drives store 350 Kbytes (double-density) or 197 Kbytes (single-density) on one side of a minidiskette. By comparison, 3740-formatted eight-inch disks store only 256 Kbytes. Enormous on-line storage capacity in a 5" drive, plus proven Percom reliability. That's what you get in a TFD-200.

the DOUBLER™ — This proprietary adapter for the TRS-80* Model I computer packs approximately twice the data on a disk track.



Depending on the type of drive, you can store up to four times as much data — 350 Kbytes — on one side of a minidiskette as you can store using a Tandy standard Model I computer drive.

Easy to install, the DOUBLER merely plugs into the disk controller chip socket of your Expansion Interface. No rewiring. No trace cutting.

And because the DOUBLER reads, writes and formats *either* single- or double-density disks, you can continue to run all of your single-density software, then switch to double-density operation at any convenient time.

Included with the PC card adapter is a TRSDOS*-compatible double-density disk operating system, called DBLDOS™, plus a CONVERT utility that converts files and programs from single- to double-density or double- to single-density format.

Each DOUBLER also includes an on-card high-performance *data separator circuit* which ensures reliable disk read operation.

The DOUBLER works with standard 35-, 40-, 77- and 80-track drives rated for double-density operation.

Note. Opening the Expansion Interface to install the DOUBLER may void Tandy's limited 90-day warranty.

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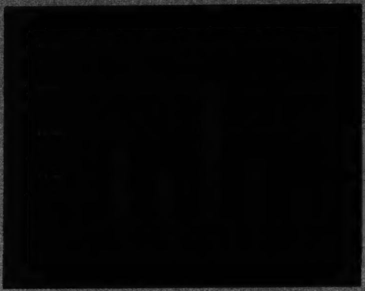

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The resolution surpasses that of a color TV picture.

BASIC/FORTRAN programming

Besides its high resolution and low price, the new SDI lets you control with optional Cromemco software packages that use simple BASIC- and FORTRAN-like commands.

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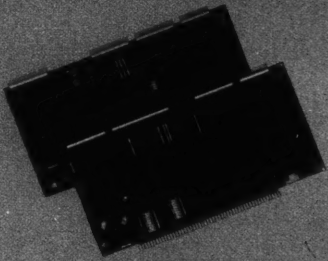

Model SDI High-Resolution Color Graphics Interface

HIGH RESOLUTION

The SDI's high resolution gives a professional-quality display that strictly meets NTSC requirements. You get 756 pixels on every visible line of the NTSC standard display of 482 image lines. Vertical line spacing is 1 pixel.

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Model SDI plugs into Z-2H 11-megabyte hard disk computer or any Cromemco computer

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The Model SDI has been used in scientific work, engineering, business, TV, color graphics, and other areas. It's a good example of how Cromemco keeps computers in the field up to date, since it turns any Cromemco computer into an up-to-date color display computer.

The SDI has still more features that you should be informed about. So contact your Cromemco representative now and see all that the SDI will do for you.

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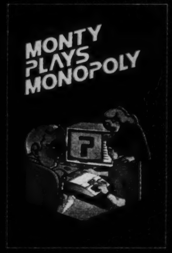
Zork, The Great Underground Empire, was created by Infocom, Inc., and is available for 32K Apple® II and II Plus and 32K TRS-80™ Model I Level II disk systems.

Also new from Personal Software is MONTY™ Plays Monopoly,* which lets an Apple or TRS-80 play America's favorite board game with the family.

Arcade Classics is a new TRS-80 action game featuring Cosmic Raiders, Pinball, Ricochet and Blockade. A great way to have fun without feeding quarters into the machines.



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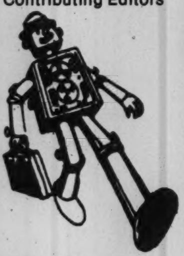

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Cooperation Games

During the past five years I and my students conceived and developed examples of computer-based cooperation games. As far as I have been able to determine I was the originator of the term "cooperation games" and of the concept it represents in computer-based games. I should be glad to hear from those interested in such games and particularly from those I have missed in my library research.

My discussion of cooperation games, these being ones in which cooperation is rewarded more than is competition among the players, is given in References 1 and 2. Cooperation games should become part of education and of interaction with others. Most computer games are competitive and often violently so. Any society or group in it affords obvious examples of cooperation and the need for it, so let's build it into our games for education and fun!

Those who wish to know more about the best version of LAFIS or Lost and Forgotten island, our most carefully developed game, should write to John Cox, 210 E. Newkirk, Tuscola, IL, 61953. We published the best version in Reference 3.

Creative Computing modified the game and published it in the March 1980 issue, called it "Another New Game from Creative Computing", and made me the author. The authors should have been Joe Taylor and John Cox, my students, with a credit line to Kent Waldrop, another student.

The Editor of *Creative Computing* has acknowledged these errors and kindly permitted me to publish this statement.

— Bruce Hicks*

References

1. Bruce Hicks, "Computer Outreach," *Computers and Society* v.7, no.3, pp. 10-14 (Fall 1976) and added references in v.7, no.4, pp. 1-2 (Winter 1977).
2. Bruce Hicks, "Peace Education: Cooperation Games and Simulations," *Peace and Change*, v.5, no.1, p. 62 (Spring 1978). Also see reprint of this note in "Notes on Recent Educational Applications of Computers," *ISEAC*** no. 15 (March 1978).
3. Joe Taylor and John Cox, "LAFIS — A Cooperation Game," *ISEAC*** no.36 (August 1979).

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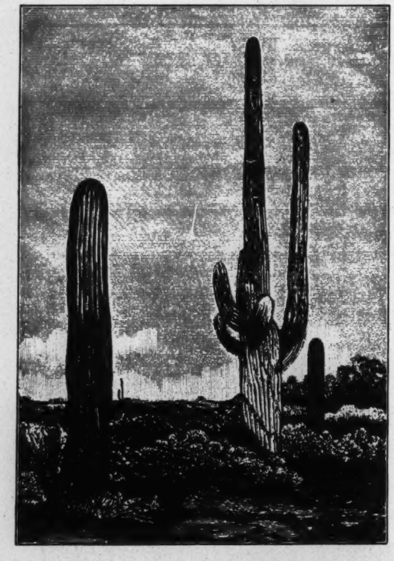
**ISEAC Illinois Series on Educational Applications of Computers. Individual copies of reports are available from the Department of Secondary Education, University of Illinois, Urbana, IL 61801.

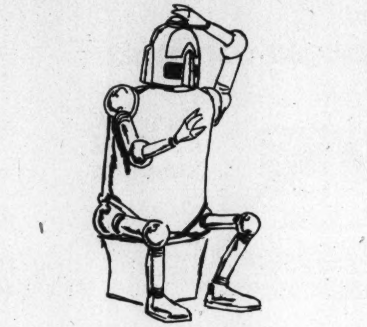
January Small Computer Conference

On January 16-17, 1981, the College of Education at Arizona State University, Tempe, Arizona will host a special small computer conference designed to introduce Educators to the many applications of computers in the classroom.

The overall goal of the conference is to provide an awareness of personal computers and their impact on society. In addition, ways that computers are currently being used in Education at the Elementary and Secondary levels, in the fine arts areas, in career and vocational education, and in special education, will be explored.

For registration materials and further information write to: Dr. Gary G. Bitter, Arizona State University, Payne 203, Tempe, Arizona 85281.





Call for Panelists, National Computer Conference, 1981

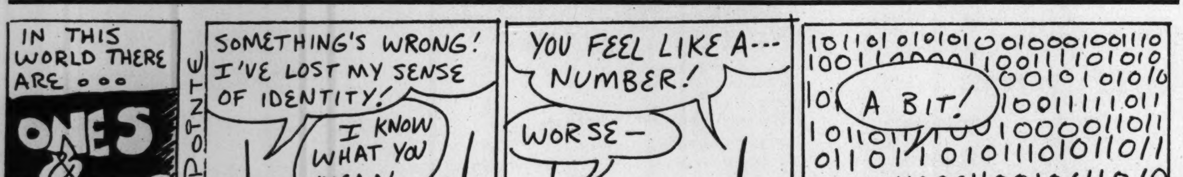
Interest is mounting for a panel to discuss Personal Robotics and Artificial Intelligence interests, applications, accomplishments. If you would like to participate in the Personal Computing Festival of NCC '81, and have expertise on a non-professional basis in robotics or AI, please write A. Gelles, 185 W. Houston St., NY, NY 10014. Send description of your area of interest, and content of a brief, 5 minute presentation, which you would be required to present as a panel member.

The conference will be held in Chicago, May 5-7, 1981. Obviously, attendance at the conference is mandatory for panel members, and is at your own expense. However, it is an honor to participate, and should be fun, to boot!

Machine Othello Tournament

The Board of Information Sciences and the Program in Experimental Psychology of the University of California at Santa Cruz have announced a two-day Othello tournament to be held January 17-18, 1981.

The tournament is open to all individuals or teams who register by January 10, 1981. Entries by individuals or teams operating small computer systems located at the tournament site are especially welcome. To register send your name(s), program designation, and equipment description to: Professor Peter W. Frey, 421 Kerr Hall, University of California, Santa Cruz, CA 95064. (408) 429-4005.


IN THIS WORLD THERE ARE ...
ONES & ZEROES
LAPOINTE
SOMETHING'S WRONG! I'VE LOST MY SENSE OF IDENTITY!
I KNOW WHAT YOU MEAN...
YOU FEEL LIKE A--- NUMBER!
WORSE-
A BIT!

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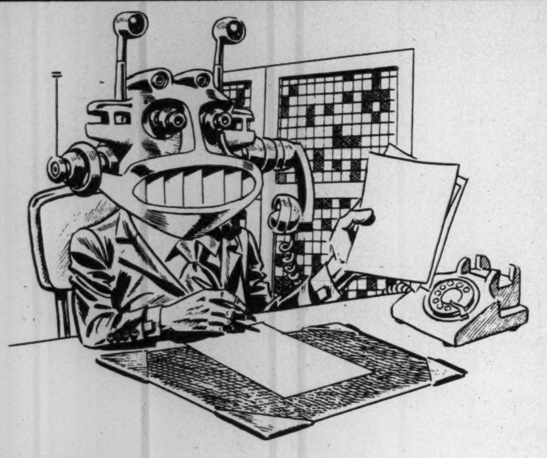

Input/ Output

43 Splats!

Dear Editor:

I refer to *Basic Computer Games - Microcomputer Edition,* and the game "Splat" on pages 151-152.

In this game, line 550 is For J = 0TO42, line 610 is Goto 540. There is no line 540. Having made 43 successful jumps, the game shut down on me! I suspect the author had something like — "Give up, man, you must be wacked!", but I would be much obliged to receive the correct version from you. Being an "expert" jumper now, I can reach 43 in an hour or so!

Apart from this bug, your book has been most enjoyable.

B.D. Heand
85 Holland Road
Kensington, London W.14
England

Just change the DIM in Line 50 to a higher number, replace all references to 42 with the new number, and delete line 610. Then you can jump to your heart's content. But don't put in too large a number — arrays eat memory. — *DL*

The original program allowed for 4000 jumps (it was written on a larger timesharing system. The choice of 42 unsuccessful jumps was totally arbitrary. — *DHA*

Help Wanted

Dear Editor:

It was a disappointment not to find a Basic program included in the article "A Method of Interpolation" which appeared in the July issue of *Creative Computing* on page 54. The article appears to be a very significant contribution to the needs of those of us who use computers professionally.

Would you please advise whether a program for the above article can be obtained and how obtaining one can be accomplished?

Thank you very much.

D.H. Hodgins, President
Merchem Associates
P.O. Box 3610
New Haven, CT 06525

The article was a guideline. It's up to clever readers to put theory into practice. Perhaps one of you who has already done so can send a copy to Mr. Hodgins. — *DL*

Out of the Closet

Dear Editor:

Of all the computer applications journals around, I must say that *Creative Computing* is probably the most diversified in content. Fantastic magazine! Keep it up.

However, I would like to comment on the article "Smart Programs, Dumb Programs" by Michael Potts (September 1980). His article, regarding the use of computer software in Computer-Aided Instruction (CAI), seemed to me to miss the point as to the application of computers to education. In the article, Mr. Potts mentioned what he considered was good and bad in the current crop of CAI programming. Of course, some programs are better than others (and this doesn't just apply to educational/software), but the main point is in how effectively the computers are supported by the teaching staff. The world's greatest program is useless if it isn't properly backed up by classroom lessons and the like. On the other hand, a marginal program, such as one teaching kids the capitals of states, can still be a valuable tool as one facet of instruction, if it is well worked into a lesson. Computers can't be relied on to totally educate kids. I must agree with Mr. Potts on the fact that many schools are not willing to take the time to properly utilize a computer system. It is really a shame to see a valuable item like a computer go unused in many school districts around the country.

Fred Brunner
670 Dunnhill Dr.
Buffalo Grove, IL 60090

Another Conception

Dear Editor:

In facing the challenge put forth in "Self-Reproducing Program Revisited" ("It seems possible to write a shorter Basic version . . . ", July 1980), I wrote two shorter programs which will run on a TRS-80 Level II machine:

```
5 READ A$, B$: PRINT A$; B$; CHR$(34); A$;
CHR$(34); CHR$(44); B$: DATA"5 READ A$, B$: PRINT
A$; B$; CHR$(34); A$; CHR$(34); CHR$(44); B$:", DATA
```

Or using no DATA statement —

```
5 A$="5 A$=: PRINTLEFT $(A$,6); CHR$(34); A$;
CHR$(34); RIGHT$(A$,52)": PRINTLEFT $(A$,6);
CHR$(34); A$; CHR$(34); RIGHT$(A$,52)
```

The second program requires that the command "CLEAR 52" be entered before it can be run successfully.

J.A. Snyder
2406 Washington Ave
Wilmington, DE 19805

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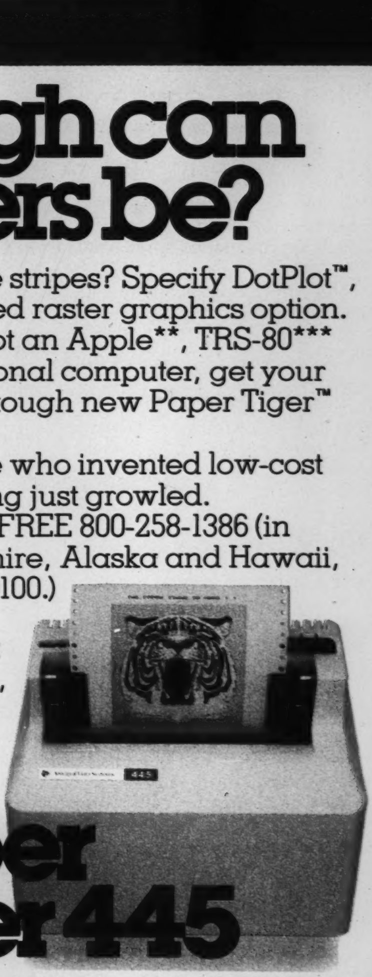

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You Can Get There From Here

Dear Editor:

In reply to Steve Gray's column in the May issue, I noted that you couldn't find a way to draw a single continuous circle using the Cartesion plotting formula. Actually, it is done quite simply. The new routine (really your old routine with the changes marked in bold) is listed below:

```
100 to 130: no changes
140 FOR X = -R TO 3*R STEP S
150 IF X < = R THEN B = X ELSE B = 2*R-X
160 IF X >R THEN A = 1
170 Y = SQR (R*R - B*B)
180 IF A = 1 THEN Y = -Y
190 SET (7*B + 64, 3*Y + 24)
200 NEXT X
210 GOTO 210
```

Gabor Salamon

* * *

Divide and Conquer

Dear Editor:

The May 1980 issue of *Creative Computing* contains an article entitled "In Search of Pi" (p124).

Although lacking in mathematical rigor and elegance, an excellent approximation to the value of Pi is obtained from

Pi = 355/113.

This simple expression provides a value (3.141592920...) which approximates Pi to an accuracy of 0.0000085%!

J. Warshawsky, Ph.D.
Vice President Research and Development
The Fuller Company
2040 Avenue C, P.O. Box 2040
Bethlehem, PA 18001

* * *

Babylon

Dear Editor:

I have been following, with interest and approval, Dr. Weiss' series on effective writing. Any efforts to reduce the bafflegab and verbal gookum that increasingly blunt American English are welcome. But yet —

Words are tools. General words and terms are surely better for conveying broad, clear concepts. However, it's a shame to use a hatchet where a scalpel seems to be called for. I admit that the word "facilitate" can be spinecurdling when encountered in every other paragraph of a report or paper. But to yank out "facilitate" and plug in "help" is to shorten at the expense of fullness of transmission of meaning. "Help" means to aid. "Facilitate" means to make easier. We "help" people to find the elevators in buildings, and we "help", for instance, handicapped or elderly people into the elevators. We "facilitate" movement between floors by designing them into the blueprints. As long as I am picking nits, I must say that to substitute "hurt" for the much righer word "inhibit" is really needless pruning. "Hurt" implies damage, diminishment, pain. "Inhibit" speaks of holding back, impeding, keeping (not necessarily negatively) from advance. Example: I built a household robot. My programming skills were not good enough. The robot ran wild and smashed the furniture, also ran over my foot. I reprogrammed the robot to recognize my foot and no longer hurt it. I inhibited the robot. It never inhibited my foot. A couple more of these short sentences and I'm going to inhibit myself.

Sarcasm aside, you can see what I'm getting at. Shakespeare, the translators of the King James Bible, Mark Twain and Loren Eisely didn't bequeath us this rich, lovely language so that we had to choose between polysyllable flak and grunt-and-point.

Or, to put it in a fashion calculated to give Dr. Weiss the itch, Refrain from defenestration of the infant subject during the ejection of the aqueous laundering medium.

Kenneth P. Greene
1692 Haight Street
San Francisco, CA 94117

* * *

The Agony and the Exidy

Dear Editor:

What Ben Cushing, in "Dear Humans, Start at Line 10," (September 1980) knows about Basic may be good and useful; but it appears that he doesn't know Basic well enough to teach his Exidy Sorcerer to write English correctly.

According to Mr. Cushing's letter, *should'nt* would be, I suppose, the contraction of *should ont.* Then he talks about *PET's* and *Apple's* as though they possess something, but neglects to explain what they possess. Since he must surely have meant *PETs* and *Apples* as plurals, I can only wonder why he was not at least consistent, constructing the opening sentence as *Many reader's of CC seem to be conscious of the shortcoming's of Basic in the area of control structure's . . .*

Maybe if the technique he suggests "does ont pan out on PET's and Apple's," it is because they know more about English than his poor mistaught Exidy!

T. E. Bailey
Associate Professor
Department of Computing and Information Services
Oklahoma State University
Stillwater, OK 74074

This is one reason we run an Effective Writing column in Creative Computing. —*DHA*

* * *

Just Deserts

Dear Editor:

Crossing the hot desert sands is a lot easier than the method hinted at in the solution given (August 1980, page 134). Anyone taking the trouble to go through this entire solution in detail would be awed at the inefficiency of the last few steps. At one point, the truck would be in the middle of the desert, with 50 gallons of gas, plus several 10-gallon caches running back toward the starting point. The solution given would have the truck return to base, gas up, and return to the middle, where 40 gallons would be left, waiting to carry it to the other side. But why not use those 40 gallons immediately to finish the crossing?

This simple change would reduce the gas used to 16 tankfuls. The best strategy can manage with slightly less than 8 tanks!

The technique of "working backwards" is ideal for this problem. The final goal is to be on the other side of the desert. The situation needed to produce this is to be one tankful away from the other side, with a full tank of gas (using numbers as in the problem and solution, this means to be at the 400-mile mark, with 40 gallons of gas). Producing this situation is now the goal we consider.

Clearly we would have to bring some gas forward to the 400-mile mark from a previous point, leave some gas, go back

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I/O, cont'd...

and get more gas, and proceed again to the 400-mile mark. Best efficiency occurs if the truck runs out of gas just as it returns to the previous point where it can get more, and if it takes on a full 40 gallons each time. If so, then 40 of the total 80 gallons are burned in 3 one-way trips, meaning each such trip is 400/3 = 133 1/3 miles.

Thus we can get across, if we reach a point 266 2/3 miles out, with 80 gallons of gas: for then we tank up, drive 133 1/3 miles forward, deposit 13 1/3 gallons, drive back 133 1/3 miles, fill up with the 40 gallons left there, and drive forward 133 1/3 miles — leaving us 400 miles out, with 26 2/3 gallons in the tank and 13 1/3 more that we pick up there.

How do we get 266 2/3 miles out, with 80 gallons? By starting 186 2/3 miles out with 120 gallons: then make two trips out 80 more miles and back, depositing 24 gallons each time, followed by a no-return trip out which leaves us with 32 gallons in the tank.

Et cetera. The distances of the legs between depots, measured in tankfuls of gas, are successively 1, 1/3, 1/5, 1/7, . . . A solution is obtained when we take enough legs so that these sume up to at least 2, which occurs for 8 legs: 1 + 1/3 + 1/5 + 1/7 + 1/9 + 1/11 + 1/13 + 1/15 is about 2.022.

The fact that this sum is slightly greater than 2 means either (a) using 8 full tanks, we could end up on the far side of the desert with about 0.022 tank (0.88 gallons) left; or (b) we could accomplish the task with less than 8 tanks, in fact about 7.673 tanks, starting our trek with 7 1/2 round trips out to a distance of about 17.95 miles.

It is worth noting that since the sum 1 + 1/3 + 1/5 + 1/7 + . . . "diverges to infinity" (i.e. gets as large as you want, if you take enough terms), the problem can be solved no matter how wide the desert is. For instance, if the desert is 10 tankfuls wide, count how many terms of the sequence are required to sum at least 10; that tells how many tankfuls will actually get you across.

Robin Ault
Concolor Allied Technical Services
45 Dexter Road
Newtonville, MA 02160

* * *

Pass Go Do Not Return To Basic

Dear Editor:

Before I got my Apple II+ in December 1979, I had been long since using Apple II computers and was just beginning to use assembly-language — wow, how convenient the reset key finally seemed: it interrupted the assembly program and left me in the monitor.

With the Apple II+, though, I was denied of that convenience, because with Autostart-Rom the reset vector goes into Applesoft Basic — terribly inconvenient for a machine user.

Then, after nearly a year of struggling, I've finally solved the problem with five pokes. They are:

115,136	$73:$88
116,24	$74:$18
1010,113 or, from monitor:	$312:$71
6280,105	$1888:$69
6281,255	$1889:$FF

The last two pokes can be set to anything. I've arbitrarily chosen the entry to the monitor. They decide where you end up.

The only drawback of the trick is that it restricts the programmer to 4K of program-space, but, for a machine programmer who grows weary of going in and out of Basic each time he hits reset, it is plenty.

Eric Shirley
89 Southampton Avenue
Berkeley, CA 94707

* * *

Out of Sorts

Dear Editor:

Regarding the article on sorting in the September 1980 issue and the Heapsort algorithm, I offer the following observations.

I compared the Heapsort to the Shell/Metzner sort. When the list to be sorted is disordered, the Heapsort appears to be about 10-15 percent faster. However, when the list to be sorted is partially ordered the Shell/Metzner sort is up to 2.25 times faster than the Heapsort.

Not only that but the Shell/Metzner sort is even smaller than the Heapsort and also requires no auxiliary storage. The test I made showed the Heapsort to require 591 bytes (for the program only) whereas the Shell/Metzner sort required only 445 bytes (again for the program only.)

On balance, if one is not sure of the "orderedness" of the list to be sorted, the Shell/Metzner sort is probably the better choice.

Below is a listing of the Shell/Metzner sort.

```
 90 REM SHELL/METZNER SORT
100 LET Y=V
110 LET Y=INT(Y/2)
120 IF Y=0 THEN 250
130 LET K=V-Y
140 LET J=1
150 LET I=J
160 LET B=I+Y
170 IF A(I)<=A(B) THEN 220
180 LET L=A(I)
190 LET A(I)=A(B)
200 LET A(B)=L
210 IF I=>1 THEN 160
220 LET J=J+1
230 IF J>K THEN 110
240 GO TO 150
250 RETURN
```

(array "A" contains the values to be sorted; "V" is the number of elements in the array; i.e., the number of items to be sorted)

Leland C. Sheppard,
Sheppard Software Co.
1523 Coronach Ave.
Sunnyvale, CA 94087

One reason we have run so much material on sorting techniques over the years is that different sorts lend themselves to different jobs. I can find little justification for ever using the popular bubble sort or delayed replacement but other sorts such as Shell/Metzner, Heapsort, Woodrum, etc., all have a place. Five sorting techniques and two shuffling algorithms are described in the 19-page "Sorting, Shuffling and File Structures" reprint available for just 50 cents postpaid from Creative Computing. — *DHA*

* * *

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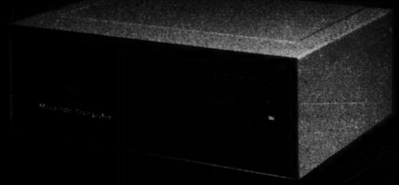

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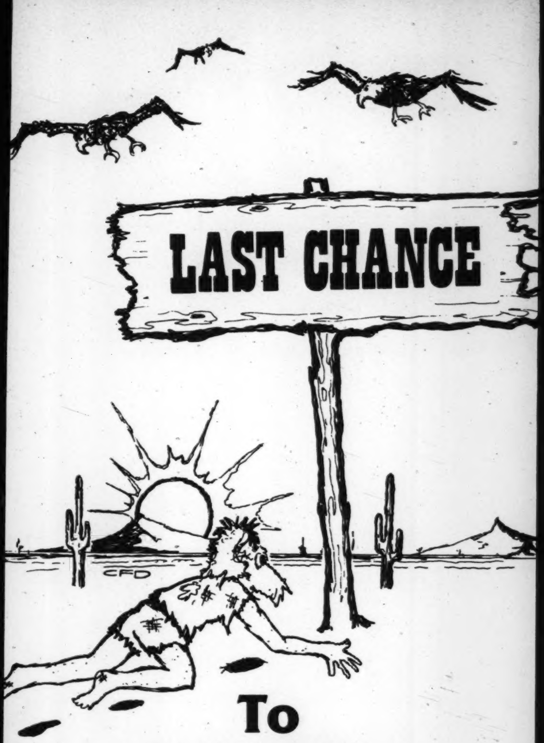

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electronic toys and games

MARY-SUE
JOHN
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SANDY!

Part II

David Lubar

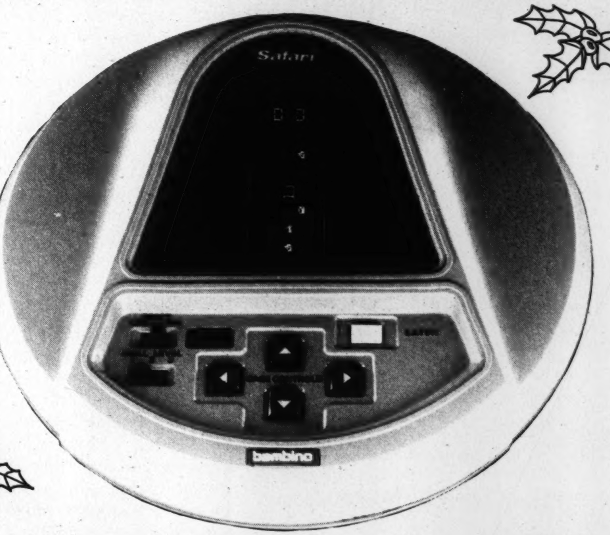
Following is presented a wide selection of toys and games, from the fast paced to the cerebral. There should be something for everyone.

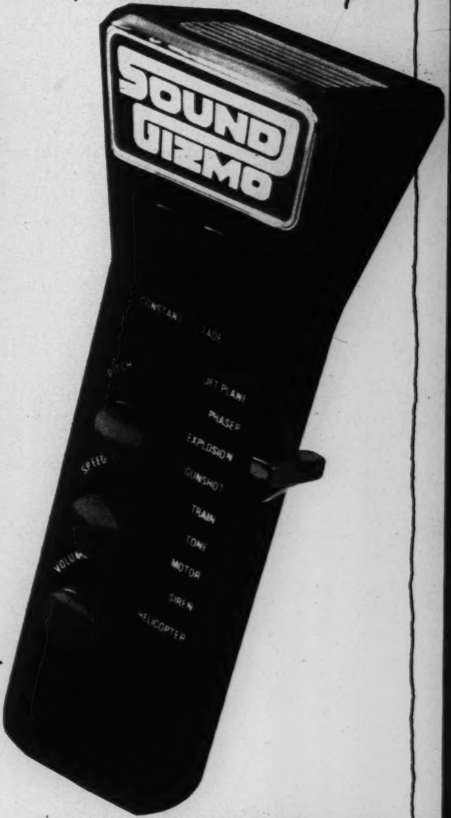
Safari, Basketball, and Bukka-Bukka Bath Toys from Bambino

Safari was a favorite with the staff. The object is to track down and cage wild animals. Four keys are used to move the cage, a fifth key shuts the door. If an animal is inside, you get a point. If you make seven captures in a row without missing, an eighth capture, when made in a corner, will net bonus points. Misses reduce your score. The animals appear at random and hop around the field, evading the cage. There are three skill levels, the third of which seems almost unconquerable.

Basketball, with tiny little players done in remarkable detail, is great fun. It can be played solo or in competition. The player attempts to move past computer-controlled opponents without losing the ball. This is done by changing dribbling heights to high, medium or low, depending on the stance of the opponent. At any point, the player can attempt a shot. The closer he is to the basket, the less the chance that the shot will be blocked. The game is timed with nine-minute quarters. Between turns, the player can press a button and see the score. I've raved enough about Bambino. Rather than say any more about their graphics or games in general, I'll leave it to you to go to the stores and see the games for yourself.

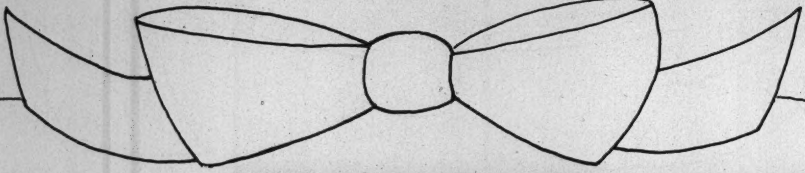
Bukka-Bukka Bath Toys are not electronic, but they are modern and innovative enough to be listed here. These small plastic animals float in the tub. Each has several windows, inside of which a number can appear. The number is the centigrade temperature of the water. This seems to be a step above elbow dipping, both in ease and accuracy.





The Sound Gizmo from Fundimensions

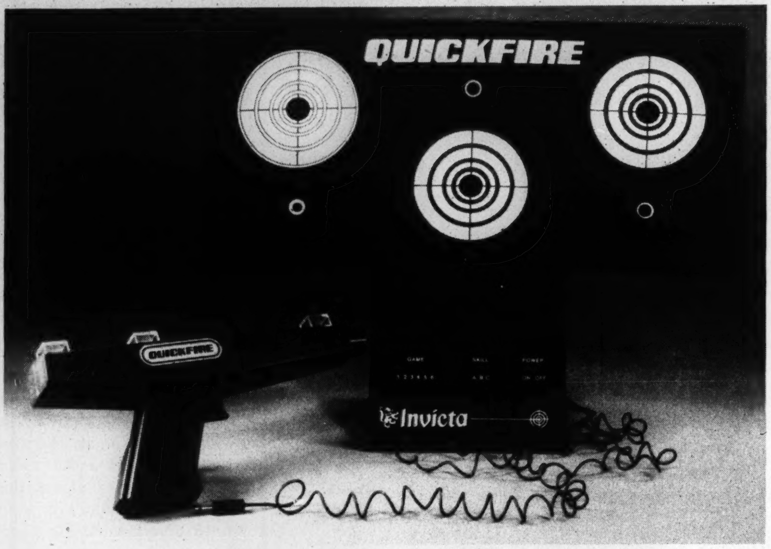
Shaped somewhat like a large safety razor, *The Sound Gizmo,* as the name implies, produces sounds. Each sound is composed of several variables. First, a sliding switch selects the basic sound, such as train, motor, or explosion. Then three knobs can be used to determine volume, pitch, and speed. Finally, two switches can be pressed; one produces constant sound, the other gives fading bursts. With all this potential for experiment, *The Sound Gizmo* is a nice toy with uses limited only by a child's imagination.



Quickfire and Vagabondo from Invicta

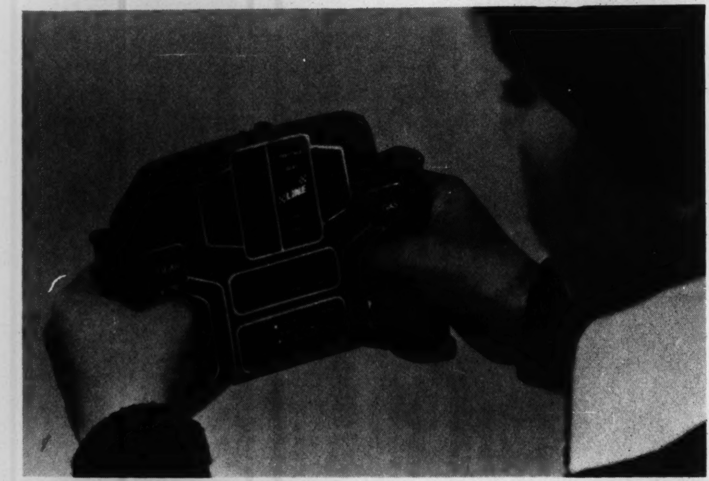
Quickfire is a two-player target game with three levels of skill. The players use a gun which shoots a beam of light at three targets. Lights above the targets indicate which target to shoot. Six games are available with the unit. One involves shooting the targets in any order, another requires you to match the pattern that is flashed. The unit, unlike earlier versions of light-gun games, works well even if the room isn't totally dark. Sound effects accompany play, and the time used by each contestant is displayed at the end of a round.

Vagabondo is a board game in which players take turns placing pieces on a board, trying to score points by covering territory and by meeting other pieces. Each player has pieces that are one of several shades, and no two pieces of the same shade can touch. *Vagabondo,* following the lead of other games from Invicta, is a contest of strategy, not luck.



Redline Electronic Drag Race from Kenner

Another winner, *Redline* simulates a drag race. The player selects the type of car he wants to drive, waits for the green light, and burns rubber. A tachometer helps you avoid blowing your engine as you shift through the gears. The sound effects are very realistic. At the end of a race, the elapsed time and speed are shown. Unfortunately, the elapsed time doesn't stay on the screen for long. If you want, two *Redlines* can be attached with a cable, allowing for competitive drag races.



Rubik's Cube from Ideal

This marvelous gadget has received a lot of coverage. A cube of twenty-seven blocks, it can be rotated in segments around any of three cross sections. The object is to obtain six faces of solid color. The cube comes correctly assembled. After a few minutes of experimenting with the unique properties of Rubik's Cube, you'll find it presents a jumble of colors that may never be whole again.

Electron Blaster from Vanity Fair

This game was another favorite with the staff. In *Electron Blaster,* you move a ship back and forth between three columns, trying to shoot down the aliens that are moving toward you. Sound familiar? To win, you have to get 99 points before time runs out. There are three skill levels. If the aliens reach the bottom, or if you are hit three times, you lose. At the top skill level, the aliens move rather rapidly, making the game a real challenge.

The Pothole Game from Cadaco

This one is really electrical, not electronic, but it just seemed different enough to include. Two players steer their cars, trying to avoid the holes, as a beltway moves beneath them. Each car has marbles inside, which drop through the holes. When you lose your marbles, you lose the game. We had a bit of trouble getting the mechanism running since the belt had a tendency to snag. But, once running, the game is fun, though it might be a bit too fast-paced for some children.

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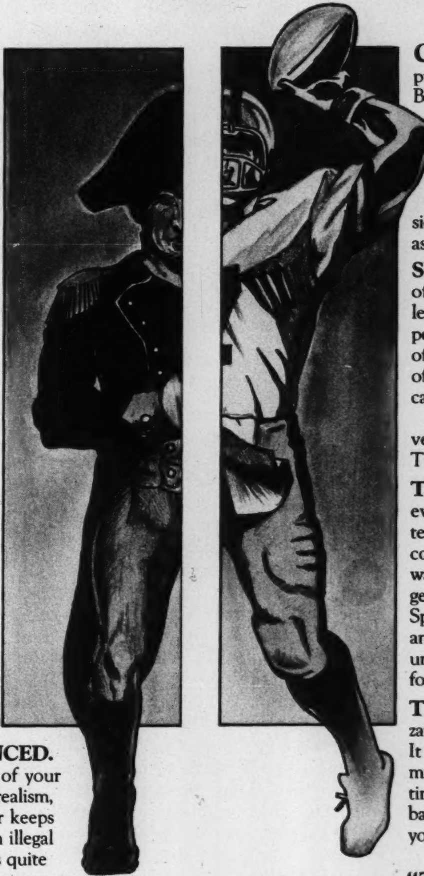

COMPUTER NAPOLEONICS™

takes you to the battlefields of Waterloo on the fateful day of June 18, 1815. Here, the greatest battle ever fought is about to begin, awaiting only your commands to set the amassed armies in motion.

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AS NAPOLEON, you must utilize your superior combat strength and numbers to deal Wellington a quick and decisive defeat before his Prussian ally can supply reinforcements. Speed is of the essence. But any tactical blunders in military deployment will result in a repeat of history – Napoleon's ignominious defeat.

AS THE DUKE OF WELLINGTON, you must not only survive the onslaught of the French artillery, cuirassiers, and the dreaded Imperial Guard, you must also inflict sufficient damage to Napoleon's forces to prevent his relentless northward march of conquest.

THE COMPUTER, in our solitaire scenario, plays Wellington while you play Napoleon. Two levels of play are provided by making the entry of Prussian reinforcements variable. This makes the need for French military decisiveness and devastating execution even more critical.

FOR THE NOVICE AND THE ADVANCED. Computer Napoleonics has all the advantages of your basic, traditional wargame –meticulous detail, realism, and playability. Plus one. Because the computer keeps track of all the rules, neither player can make an illegal move. This makes learning it a cinch (mastery is quite another matter), and it will convert the novice wargamer into a fanatic in no time.

The advanced wargamer will find the computer a worthy opponent indeed, and the two levels of play in the solitaire version will challenge the most experienced of strategists.

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propels you onto the playing field of the Super Bowl. From its multiple offensive and defensive plays and its real-time playing conditions to the animated video display of the gridiron and the halftime statistics, no strategy football game has ever been more complete in detail or as exciting in realism. Three versions are offered: Semi-Pro, Pro, and Computer-as-Opponent.

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After you have mastered the Semi-Pro version, it's time to move on to the Big Time...the Pro version!

THE PRO VERSION not only gives you every offense (36) and defense (24 plus double-teaming capabilities and special alignments) you could ever want, it also gives you the team you want! With 2.7 million computer dollars, you get to draft a team to your style and specifications. Spend more on your quarterback and receivers and your passing game may very well be unstoppable...but your running game may suffer for lack of funds.

THE COMPUTER eliminates all the organizational drudgery of conventional board games. It plays scorekeeper, referee, umpire, and linesman. As timekeeper, it makes you play in real-time. Take longer than 30 seconds to hike the ball and five yards will be marched off against you for delay-of-game.

"THE ROBOTS" is the team most ably coached by your friendly computer. It's ready to play any time you are. It even "learns" your tendencies and patterns through time, and it will make the necessary tactical adjustments. It plays so well you must be in top form to stand a chance against it.

All you need to start on these mind journeys is an Apple II with Applesoft ROM card, 48K memory, and a mini-floppy disc drive. For $59.95, Computer Napoleonics comes with the game program mini-disc, two mapboard cards, a rule book, and two player-aid charts. Computer Quarterback, for $39.95, gives you the game disc, a rule book, and four play diagram charts.

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*Creative Computing, Aug. 1980.

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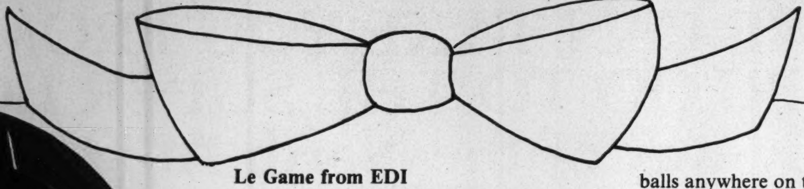


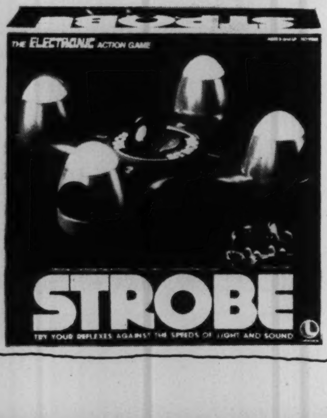
Melody Madness

Melody Madness from GAF

This is a musical version of concentration. The player or players press a button, which produces a tune. Then, a second button must be found which produces the same tune. Once matched, a button will no longer play the tune. There are several skill levels, and the tunes are reassigned to new buttons for each game. Another option allows the unit to be used as a musical instrument. Number-coded songs are included in the instruction manual. All in all, the game is a nice variation on an old concept.

Strobe from Lakeside

The game is composed of a unit with four arms. Each arm has a light on the end and a concealed panel of buttons. In various games, the object is to send the light on to the other player or players by pushing the correct button. One to four can participate. When a player misses, he is out of that round. Unfortunately, this quickly reduces the game to a contest between two players, where each has only one button to press. *Strobe* would be more interesting if it kept a running score and allowed all players to stay in until the end.


THE ELECTRONIC ACTION GAME
STROBE
TRY YOUR REFLEXES AGAINST THE SPEEDS OF LIGHT AND SOUND

Le Game from EDI

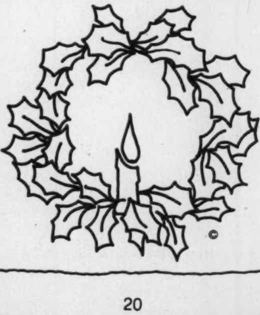
Actually, this is Le *Many* Games. The basic version is a board on which "programmed" sheets are placed. These sheets are filled in by the players using an ordinary pencil. Over the sheet goes a game board. The players then take turns touching a portion of the board with a stylus. At certain times, when the stylus is above one of the concealed pencil marks, a light will go on. In different games, this signifies different things. For example, it could indicate the blocked path in a maze, or a free area in a treasure hunt. The game sheets can be saved and reused. *Le Game* is a nice concept, and a variety of games are available. Once the *Le Game* pencil is used up, any soft pencil can be used. Some enterprising children might even try devising their own games and program sheets.

Wildfire, Split Second, and Bank Shot from Parker Brothers

Parker Brothers has come out with some very nice games. *Wildfire* is an electronic pinball game. One to four players can participate, and there are three skill levels. The game has flippers, bumpers, gates, a kicker, and lots of sound. It's fun and challenging, as well as being sturdy and well designed.

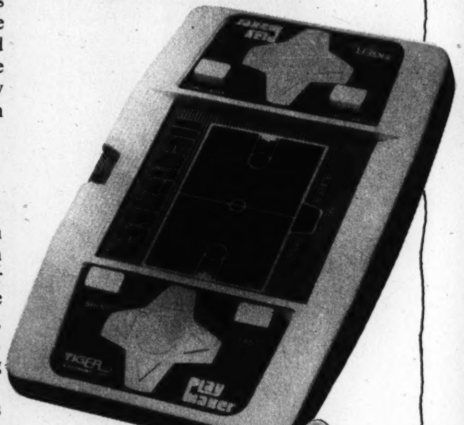
Split second comes with five games and three variations; eight ways to play in all. The games are clever and range from simple to difficult. While playing any individual game, the player's best score is kept in memory. If he does better, the game emits a high sound. If he doesn't do better, he gets a low tone. One game involves getting through mazes. Another requires you to shoot down enemy ships. The most difficult game involves manipulating a four-segment line, trying to trap a ball. This is one game that won't become quickly boring.

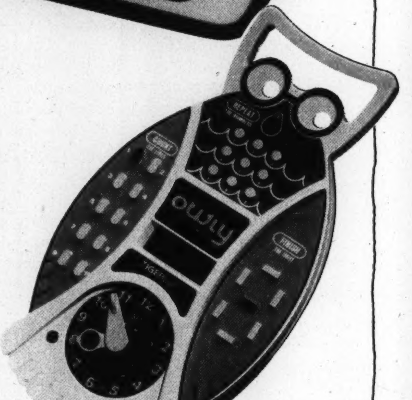
Bank Shot is a pool game. One or two players can play regular pool, poison, or try trick shots. There are six balls and a cue ball involved. The stroke can be made at different angles, with different speeds. In the trick-shot mode, you can set up the balls anywhere on the table. *Poison* is like regular pool, but has one specific ball that has to be pocketed last. *Bank Shot* is well done.



Playmaker and Owly from Tiger

Playmaker contains three games — hockey, soccer, and basketball — that are similar in design and control to the football game reviewed last month. They use a special button which allows four-way control of the lights on the field. The games are for one or two, and are differentiated by using overlays on the screen.





Owly, for the wee crowd, presents problems in time telling, and number and pattern recognition. Problems are displayed in the center, using seven-segment LED's. The answers are entered in various ways, such as using a clock to match the displayed time, or pressing bars to match the missing segment of a display. Tones and music are used to note correct and incorrect responses.

Sonic Phaser from Kusan

This gun doesn't shoot anything, but it makes a variety of sounds. A sliding switch on the side selects the sound, with choices including "radiate," "anti gravity," and "ion transport." The *Phaser* seems best suited as an adjunct to games as opposed to being a game in itself. Children playing futuristic versions of cowboys and indians (Skywalkers and Vaders?) might enjoy having ready-made sound effects.

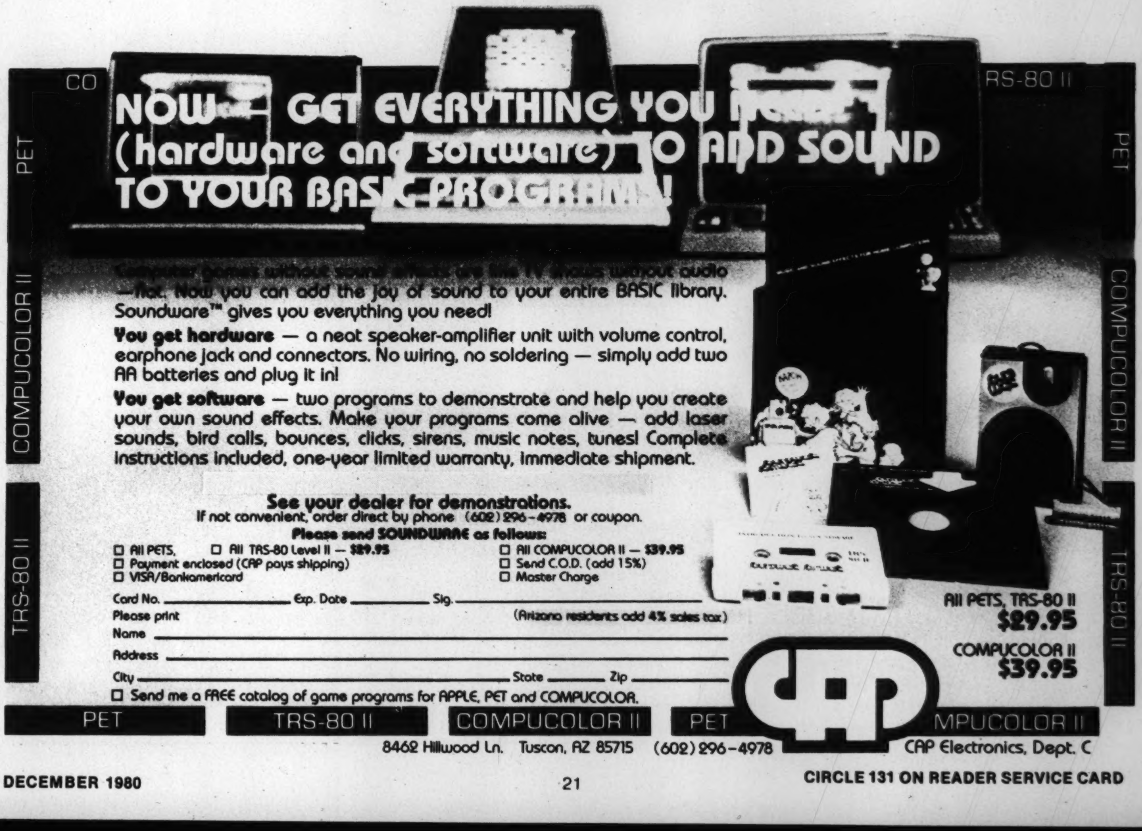
Two Player Baseball and Kiddy Computer from Fonas

One or two players can participate in this version of baseball. When played in competition, the pitcher has a choice of throwing a slow or fast ball which can be either straight or curved. There is also a button which allows him to attempt a pick off. All moves made by the pitcher are concealed by a flip-up screen. The batter can attempt to steal whenever he has a man on base. *Two Player Baseball* has all the features of the real game except for unruly crowds and nearsighted umpires. The unit is sturdy and well designed, though the lights show up best in a dimly-lit room.

FONAS
STRIKE
STEAL
PITCH
SCORE

Kiddy Computer presents math problems in several manners. The player has a choice of two skill levels and two speeds. At this point, ten problems are randomly chosen and presented on the screen. There are two other modes of operation. In one, the problems are presented with one of the factors going in sequence from one to ten. Another mode gives problems with an answer, but one of the factors is missing and has to be supplied. Two *Kiddie Computers* can be linked, allowing competition. Some users found the sound made by the unit to be rather loud.

That wraps things up for this Christmas season, leaving us plenty of time to speculate on what next year will bring. ☐



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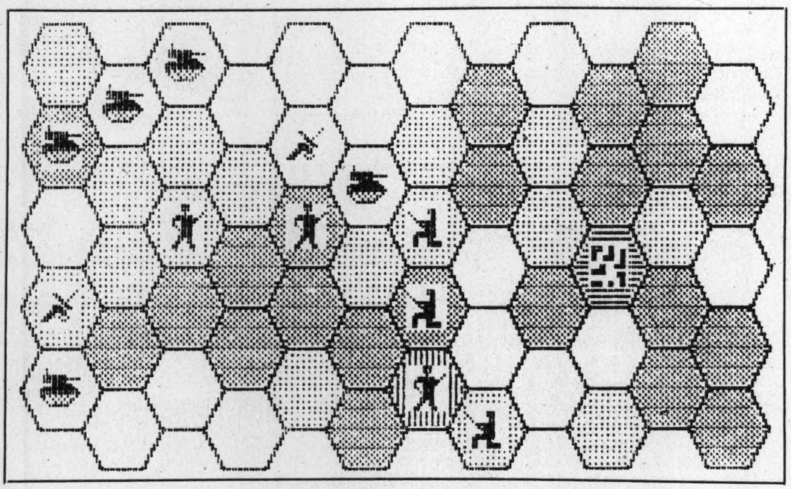
SOFTWARE PROFILE

Software, Hardware and Otherware for Christmas

David Lubar

Tired of giving and getting clothes, trinkets, and candy? If you are, this list of games, utilities, books, and other goodies should be left open in an appropriate spot with the desired items circled.



An early stage of *Conflict*

Games

Conflict, from Keating Computer Services Pty Ltd, is a war game done in high resolution for a 32K Apple with Applesoft. Combat takes place on a hex grid with varying terrain. The player has tanks, infantry and heavy weapons; each with motion and strength points. At the start, you can choose from five scenarios, or specify your own with such factors as increased enemy strength, decreased enemy movement, or random terrain. The object is to score 100 points before the enemy (Apple). You get points for occupying the city. The enemy gets points for reaching your boarder or keeping you from the city. Enemy pieces are not displaced until they are adjacent to one of your pieces. The computer takes care of combat, drawing results from a table based on the strength of opposing pieces, and taking terrain into account. For those who like war games, this is a great program. For those who don't, this program might change their minds.

Jagdstaffel, from Discovery games, comes with Apple, PET, and TRS-80 versions on one cassette, packaged in a classy container suitable for bookshelves or other niches. All versions require 16K, and the package costs $19.95. The game pits your plane against a group of bombers and escorts, all of which are represented on a text screen. You control the plane with short commands such as "A4" for "Attack and dive 4000 feet." The object is to prevent the bombers from reaching the edge of the screen. The player has a choice of a dozen or so planes, and the enemy planes are also different for each game. The program accurately reflects the characteristics of the planes, and it is up to the player to learn which maneuvers work best for each plane. *Jagdstaffel* is one of a series of similar games, each of which involves a different set of planes. War buffs might want to try several versions, other would probably be satisfied with one.

Adventure International offers *Slag* for 16K TRS-80 ($15.00). Two to twelve players build industries and buy weapons, then try to blow each other up. During the combat phase, the defending country gets to shoot ground-based missiles at the attacking I.C.B.M.'s and bombers. Spy networks can also be created. The game continues until only one player is left. On the lighter side, AI also offers *Frog* ($10.00), another TRS-80 game, with marvelous graphics. The game has a frog on a log. The player moves the frog and tries to catch flies with a darting tongue. The game is fun, though it can get tough when there is only one fly left. *Mountain Shoot* ($7.95), for 16K Atari is a nice version of ballistic-type games. Two players take turns choosing amount of powder and trajectory, trying to blow each

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Otherware, cont'd...

other up. The wind speed changes each turn, adding challenge to the game. Another Atari Game, *Deflection* ($8.00), puts a moving ball on a screen containing target balls. Whenever the "/" key is pressed, a "/" is placed on the screen, deflecting the ball. The object is to remove all the targets. It is possible to trap yourself in a corner. In this case, the only way out is with the "system reset" button. Still, the game is fun.

The Voice from MUSE, a 48K disk for the Apple II or II Plus ($39.95), allows the computer to speak. No hardware is needed since the internal speaker is used. The program has several parts. A demo persents a low-resolution face with moving mouth and a accompanying speech. Another program allows you to enter words and phrases, using either a microphone or cassette. Once words have been stored on disk, they can be retrieved and combined into sentences. The documentation explains how to combine *The Voice* with other programs. The sound quality can be improved by hooking the output to an external speaker, but, even through the Apple's speaker, the words are understandable. With options for changing the speed of the words, and the ability to build a library of words, you can get some interesting effects from *The Voice*.

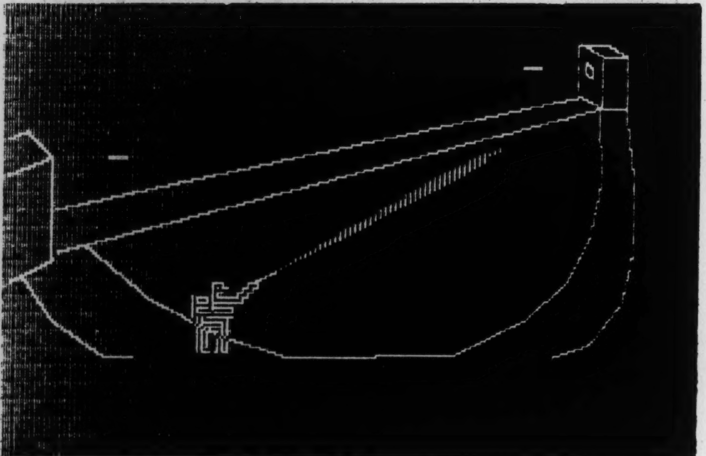
Tandy brings the TRS-80 into the space age with their *Astrology* tape ($29.95). You enter your time and date of birth, latitude and longitude of place of birth, then sit back and watch as the computer produces all the information needed to cast charts. Everything concerning rising signs, cusps, and other crucial data is produced. If desired, the output can be sent to a printer. The program comes with a nicely done chart containing the zodiac and lots of other information.

Hayden's *Microsail* for the PET ($11.95) allows you to sail the CRT, racing a path around buoys. The tape requires 8K. There are several skill levels, and the player can control the angle of the sail and rudder, and raise or lower the centerboard. Our resident salt assures me that the game is accurate, with the boat responding just the way a real one would. If you aren't careful, you can tip over, ending the race. Text at the top of the screen keeps you informed of all the essential information, including angle of sail, wind direction, and rudder direction.

Skeet ($19.95), an Apple disk in machine language, from On-Line Systems, lets one to five players compete in a shooting contest. There is a choice of speed, skeet size, and spread of pellets. Players shoot from a number of positions, and the skeets come either singly or in pairs from two points on the high-resolution screen. *Mystery Mansion* ($24.95), in high resolution, should please *Adventure* fans. The game takes place in a large house. The occupants are being murdered. The graphics are very nice, showing the rooms and objects in detail. I wish I could tell you more about the game, but I keep getting lost in the forest outside the kitchen. Both disks require 48K.

Utilities

DOSPLUS 3.1 from Micro Systems Software, Inc. is a disk operating system for the TRS-80, incorporating a lot of nice features. For example, by pushing Shift and Clear, you can send whatever is on the screen to a printer. Unprintable characters will come out as periods. If the printer isn't on, the system won't hang. DOSPLUS offers monitor features, including listing an area of memory as either hex code or ASCII data. Another command displays free disk space. Obviously, the creators of this system knew what they wanted and knew how to achieve their desires. Selling for $99.95, DOSPLUS isn't for everyone. But those who need a friendly operating system with a lot of useful functions might find this item worth considering.



A shooter in the act of missing both skeets

Programmer, a TRS-80 tape utility from Rational Software, provides some useful functions. It loads into high memory and is accessed by hitting shift-break. With it, you can delete lines, move lines, pack programs, append programs, and renumber. Append seems especially useful. A program on tape can be added to one in memory. You specify the starting line number for the program on tape, and the step. Unfortunately, this renumbering of the tape program plays havoc with referenced lines. Still, for adding short subroutines, Append is useful. The Pack function strips REMs and removes all extra spaces.Move allows you to take a line or lines from one section and place them elsewhere. Since Programmer is in machine code, the utilities execute rapidly.

Apple-Doc ($19.95) from Southwestern Data Systems contains three utilities that run in ROM or RAM Applesoft. "Vardoc" produces a list of variables contained in any program in memory. "Linedoc" gives a list of referenced lines and the lines calling them. "Replace" allows you to rename any variable or replace any string. This replacement capability has many uses, such as serving as an aid when converting Integer Basic programs to Applesoft, or for changing the variables in a subroutine which is appended to various programs.

Peripherals

The Musicraft Development System from Newtech Computer systems, Inc. was covered in October, but mention should be made of the Music Box, a peripheral which allows the TRS-80 to produce four-voice music. The box plugs into the keyboard or the expansion interface. It comes with an AC adaptor and a cable for connecting to a speaker. The unit can drive a small speaker, but an amplifier is required if you are using large speakers. The box is attractive; painted to resemble a keyboard, and the manual that comes with the system is comprehensive and well done. The Music Box, with software and hardware, sells for under $200.

For Apple owners who want an easy method of entering graphics, there is the Versa Writer from Peripherals Plus ($252). Thanks to great software, this device does things that bit pads can't do, such as creating shape tables and allowing over 100 colors on the Apple's high resolution screen. The Versa Writer was reviewed in June '79. Since then, the software has been rewritten in machine code, giving much faster operation.

Books

Godël, Escher, Bach almost defies description. The author, Douglas Hofstadt, blends music, art, and mathematics. This $8.95 paperback explores fugues, canons, lithographs, and set theory — to name a few areas touched. Several sections are devoted to computers and artificial intelligence. The format involves chapters on various matters alternating with fascinating dialogues between Archilles and the Tortoise. This book will delight anyone who is intrigued by the lore of numbers.

Tales of the Marvelous Machine ($7.95) takes 35 stories — some from the pages of *Creative Computing*, many previously unpublished — adds a lot of new artwork, and guarantees a great way to pass those long winter nights. The book starts off with a variety of indexes. You can choose stories by length or content, or by the role played by the computer.

For Science Fiction fans, Creative Computing Press also offers *Masterpieces of Science Fiction* ($7.95), a large-format book filled with color illustrations, and graced with nine classics from such authors as Harlan Ellison, Robert Heinlein, and Issac Asimov. The book is also a great way to hook those who haven't yet become addicted to science fiction. ☐

Vendor Addresses

Discovery Games
936 W. Highway 36
St. Paul, MN 55113

Muse
330 N. Charles St.
Baltimore, MD 21201

Hayden
50 Essex St.
Rochelle Park, NJ 07662

Tandy
One Tandy Center
Fort Worth, TX 76102

Micro Systems Software
5846 Funston St.
Hollywood, FL 33023

Adventure International
Box 3435
Longwood, FL 32750

Creative Computing Press
P.O. Box 789-M
Morristown, NJ 07960

Newtech Computer Systems, Inc.
230 Clinton St.
Brooklyn, NY 11201

Southwestern Data Systems
P.O. Box 582
Santee, CA 92071

Rational Software
963 E. California Blvd.
Pasadena, CA 91106
Keating Computer Services Pty Ltd
P.O. Box 448
Double Bay, Australia 2028

Peripherals Plus
119 Maple Avenue
Morristown, NJ 07960

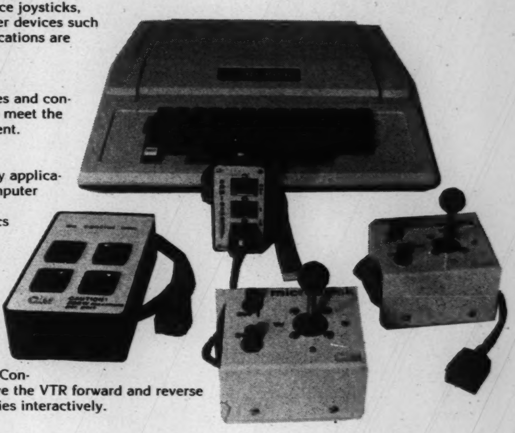
On Line Systems
772 N. Holbrook St.
Simi Valley, CA 93065

Presenting the

CJM Microsystem

For the Apple II

The CJM Microsystem for the Apple II
The CJM Microsystem now provides Apple owners with the hardware they need to interface joysticks, sense external inputs, and control other devices such as audio or video recorders. The applications are endless.

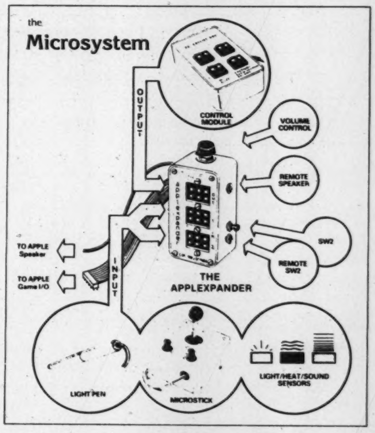


Institutional Standards
All metal chassis and heavy duty cables and connectors allow the CJM Microsystem to meet the demands of the educational environment.

A Variety of Applications
The Microsystem can be used for many applications from games to sophisticated computer assisted instruction.
The Miscrostik can be used for graphics input, menu selection, or any screen oriented function.
The output modules such as the Microbox can run appliances, lamps, motors, relays or other loads from keyboard or program commands.
The input modules can sense temperature, light, or sound to provide external information.
Specialized modules, such as the VTR Controller can sense tape position and drive the VTR forward and reverse utilizing the input and output capabilities interactively.

The Graphics Kit Software
This is a disk based program written in Integer Basic and Assembly Language. It uses the Microstiks to simulate the Apple Graphics Pad and adds some extra features, including:

- Draw shapes in 8 modes using Microstiks.
- Draw to both HIRES screens.
- Assemble shapes into tables.
- Select a color from the pallette using the Microstik cursor.
- Add text directly to drawings with auto scrolling in either direction.
- Move shapes around the HIRES screens and deposit them at the touch of a button. Press the button again to pick them up off the screen and move them to a new location. Press a key to rotate the shape. Press another to bring up the next shape.
- There are more than 50 distinct drawing commands.
- The Animate Command cuts from screen 1 to screen two and back again.
- The Save Command saves either screen for later use in custom programs as charts or graphs (ideal for CAI applications).



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The Applexpander
The APPLEXPANDER is the heart of the CJM MICROSYSTEM. The Applexpander plugs into the Apple Game I/O socket. Once the expander is installed there will never be another need to access the game socket. The expander buffers the input and output signals to the Game I/O. Providing the added safety needed to interface to the outside world.
The two input sockets accept a Microstik, Light Pen or an assortment of input devices such as temperature, audio or light sensors.
The output socket will drive the AC Control Box, Relay Modules, LED Arrays and other controllers.
The APPLEXPANDER+S includes an Auxilliary Speaker/Headphone Jack, and Volume Control. The Apple speaker is automatically muted when a speaker is plugged into the remote jack. The volume control adjusts the sound level. When an external speaker (not included) is used, the sound quality of the Apple increases dramatically.

Microstik
The CJM MICROSTIK is a dual axis joystick. It features an all metal rugged chassis, with a heavy duty cable and Jones plug. Each Microstik includes two pushbuttons for interactive control. Additional circuitry reduces the current draw so that two Microstiks can safely be used simultaneously through the game socket. These are high quality units constructed to withstand abuse. Extension cables are available as accessories.

CJM

CIRCLE 159 ON READER SERVICE CARD

Christmas Buyers Guide

The computers included in this chart were selected with the aim of giving a wide representation to as many different types of machines as possible. Some of the categories require a few words of explanation. Graphic resolution can be represented in several ways. Effective resolution is the actual number of dots or pixels that can be put on the screen. In some cases, the user has control only over characters composed of a matrix of pixels. Thus, a machine with an effective resolution of, say, 200 X 200 might have a programmable control over only a 40 X 40 grid.

Available peripherals refers to those accessories from the manufacturer of the computer. This is a representative list and is not intended to cover the complete line of peripherals. Outside availability concerns software and hardware from other manufacturers. Again, the examples are representative. The prices given are based on manufacturers suggested list. Most systems can be obtained for a lower price.

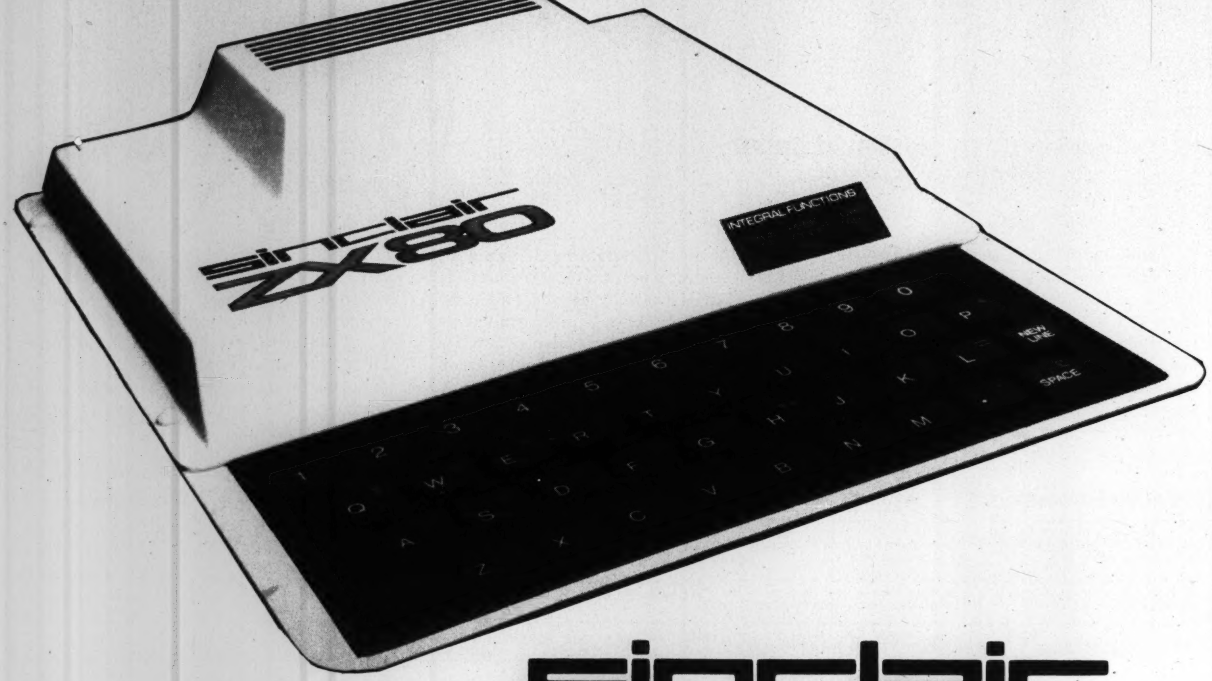
	Sinclair ZX80	Commodore PET/CBM	OSI C4P	Heath WH89	Atari 800
Description of System	Compact unit with pressure-sensitive keyboard and CPU	Keyboard, CPU and monitor in a single metal unit	Keyboard and CPU in metal and wood case	Keyboard, CPU, monitor and disk in metal case	Keyboard and CPU in plastic case with metal shielding, cassette in separate unit.
Memory	1-16K RAM 4 or 8K Basic in ROM	8-48K RAM 16K ROM	8-32K RAM, 8K Basic in ROM	16-48K RAM 6K ROM	16-48K RAM up to 26K ROM
Processor	Z-80	6502	6502	Z-80	6502
Basic	Integer Basic	Commodore Basic — a version of Microsoft	OSI Basic	Benton Harbor Basic or Microsoft Basic available through software	Atari Basic — includes extensive commands for graphics, music, and paddles
Monitor Accessibility	Through PEEK and POKE. Z-80 code can be entered as strings	Some user access, assembler programs available	Assembler programs available	Assembler programs available	Assembler cartridge needed
Other Available Languages	None	None	Fortran, Pascal	Pascal	Pascal (1981) Microsoft Basic (1981)
Graphics and Color	B+W with 22 special symbols, 24 X 32	B+W, special graphics symbols 25 X 40 display	256 X 512 effective resolution with 16 colors. Predefined graphics characters available	33 graphics characters available, each composed of an 8 X 10 matrix. B+W	Several modes, from 40 X 24 with 4 colors to 192 X 320 with 2 colors
Text	Upper case 24 X 32	25 X 40 upper and lower case	64 X 32 upper and lower case	24 X 80 upper and lower case	24 X 32 upper and lower case.
Sound Capabilities	None	Through external devices	Built in DAC and tone generator	Through external devices	4 voices plus speaker
External Storage Devices	Cassette (250 baud), disk promised in near future	Cassette, dual disks (360K)	Cassette (300 baud), disk (77.8K)	Cassette (baud rate selectable up to 9600) or disk	Cassette, disk (80 for 1st drive, 86K for drives 2, 3 and 4)
Unincluded Requirements	Cassette and TV	Cassette	Cassette or disk, monitor	Language software	TV
Expansion and Interfacing	Through edge card	IEEE bus, 2nd cassette port, memory expansion bus	4 expansion slots, printer interface, AC remote control, joystick interface	Sockets for memory, two port serial interface	Serial port
Available Peripherals	Plans for printer, disk, and flat-screen TV	Modem, voice synthesizer, disk, cassette, printer	Monitor, joysticks, modem, AC remote control switches, printer	Disks, modem, printer, interface boards	Disk drives, printer, modem, joystick
Outside Software Availability	Some	Good	Some	Little	Fair, getting better
Outside Hardware Availability	None yet	Good, including music boards, S-100 expansion interface, and joysticks	Some	Little	Little
Documentation	Good	Good but not thorough	Good but unorganized	Good	Good, but some decoding required
Dependability	Good	Good	Fair	Good	Good
Service	Return to manufacturer	Available at some dealers or mail in	Available at some dealers, mostly mail in	Through Heath Cervice Centers	From many dealers or Control Data Centers
Price of Basic System	$199.95 for 1K	$995 for 16K	$ 698 for 8K	$1195 for 16K kit without disk	$1080 for 16K
Price of System with Disk	NA	$2590 for 32K with dual disks	$1695 for 24K with disk (C4P MF)	$2895 for 48K with disk, assembled	$2000 for 32K with disk
Comments	Very popular in Europe. Provides a very low cost introduction to programming	A nice unit with some good features, especially popular with educators since it is self contained.	OSI has a history of innovative hardware at a low price, but indifferent factory support.	Heath has an excellent reputation in the electronics field. The use of RAM for languages allows many future applications.	The Atari is growing in popularity. Many vendors will probably be adding Atari products to their lines of software and hardware.

David Lubar

This year, the buyer's guide to personal computers expands, branching in several directions. For quick reference, there is the comparison chart which covers ten computers — both old timers and newcomers. On this chart, you can find machines from under $200 to over $1000, with a wide variety of features and capabilities. Next comes an in-depth look at four of the most popular home computers. Each article was written by someone who has worked extensively with that particular computer; each presents a favorable but balanced view. There are also reviews of two new entries, the TRS-80 Pocket Computer and the Sinclair ZX80. These computers represent a significant step in the evolution of home computing, both in portability and price. For those who want to dig in, there is a comparison of Basics which deals with both available features and speed of execution.

For those who already have a computer, or need a gift idea, there is a review of software, peripherals, and books. That about covers this years buyer's guide. Happy shopping. — DL

Exidy Sorcerer	Apple II Plus	TRS-80 Level II	TI 99/4	APF Imagination Machine
Keyboard, CPU, and socket for ROM cartridges in plastic case	Keyboard and CPU in a plastic case with metal bottom	Keyboard and CPU in single black plastic unit, cassette and monitor in separate units	Compact metal and plastic keyboard and CPU, separate monitor	Keyboard, CPU, cassette, and slots for ROM cartridges in a plastic case
8-48K RAM 12K ROM and ROM cartridges	16-48K RAM, 16K ROM (8K Basic, 4K monitor, 4K hardware switches)	4-48K RAM 16K ROM	16K RAM, 26K ROM, Additional 30K from ROM cartridges	9-17K RAM, 14K Basic in ROM
Z-80	6502	Z-80	9900	MC6800
8K Microsoft Basic	Applesoft — Version of Microsoft with extended commands for graphics and paddles	Level II Basic, a version of Microsoft with extensions for graphics	TI Basic with special commands for sound and graphics	APF Basic; similar to Microsoft, but without trig functions or extended string handling.
Accessible with assembler cartridge	Memory is open to inspection and change, disassembler included.	Special software required for access. PEEK and POKE available from Basic	Not accessible to user	System supports 6800 programming
Fortran	Integer Basic, Pascal, Pilot	Fortran	None	None
B+W, special graphics symbols included with effective resolution of 512 X 240. User can define special characters.	40 X 48 with 16 colors, 280 X 192 with 6 colors	B+W 48 X 128 using graphics characters with 3 X 2 blocks, giving programmable control of 16 X 64	192 x 256 with 8 X 8 characters for a programmable control of 24 X 32 with 16 colors	Several modes — 192 X 256 with 4 colors, 192 X 128 with 8 colors, using defined shapes of 4 X 16
30 X 64 upper and lower case	24 X 40 upper case	16 X 64 upper case	24 X 32 upper case	32 X 16 upper case
Through external devices	Built in speaker	Through peripherals	Three voices through audio channel of monitor	Built in speaker and Synthesizer
Cassette or disk (315K)	Cassette (1200 baud), disk (100K, up to 14 drives)	Cassette (500 baud) Disk (55K for 1st drive, 85K for 2, 3, and 4)	Cassette, disk	Cassette (1500 baud), Disk (72K)
Cassette or disk, monitor	Monitor or TV and RF modulator, cassette or disk	None	Cassette	TV
S-100 expansion box available, second cassette port and parallel port on board	8 expansion slots for peripheral cards, dip plug for joysticks or paddles	Expansion interface used for additional RAM above 16K and peripherals, edge card for printer on board.	Two ports for TI peripherals and controllers	Optional expansion box
Disk, monitor	Integer firmware card, language system, disk drive, printer, modem	Printers, disk, speech synthesizer	Speech synthesizer, modem, printer, joysticks, disk (announced)	Disk, expansion box
Moderate	Excellent	Excellent	Little yet	None
Excellent if the expansion box is used	Excellent — including boards for speech and music, light pen, printers, bit pads, and joysticks	Excellent, including music, speech, light pens, and printers	Little yet	None
Fair	Thorough and well done	Good	Good	Fair
Good	Good	Fair	Good	Too new to tell
Through some dealers or mail in	Available at all authorized dealers. Quality varies	From 86 service centers across the country	Through some dealers or mail in	Mail in
$895 for 8K	$1195 for 16K	$649 for 4K, $768 for 16K	$1150	$599 for 9K
$2250 for 32K with dual disks	$1950 for 32K with disk	$1580	$ 1650 for 16K with disk	$995 for 9K and disk
A very capable computer suffering from lack of support by Exidy. The recent sale of the computer division might help.	An established machine with continuing support from Apple and other manufacturers. Many active users groups.	A very popular computer with many users groups. Available software and hardware will continue to grow.	The TI has the best speech synthesis available in a small computer	A low-cost way to get started



sinclair ZX80

David Tebbutt

Clive Sinclair has surprised the world with the launch of his attractive, hand-held personal computer. Costing less than $200, and plugging into a TV and cassette recorder, some now suggest the ZX80 to represent the thin edge of a mass consumer market wedge.

Introduction

Sinclair Research set out to build a simple to use personal computer running Basic and capable of breaking the psychological price barrier of $200. Well, they succeeded with their ZX80. Why ZX80? No reason really except that it's based on an NEC copy of the Z80 processor chip . . . and it sounds nice.

The machine is available by mail order only; there are no plans to sell it in stores — yet. The kit version is only available in the U.K.; in the U.S. the assembled version costs $200 and includes an AC power supply.

The ZX80 is amazingly light, twelve ounces in fact, and easily held in one hand. The low weight is achieved through use of a moulded plastic casing just 1mm thick.

It connects quite happily to the television set and the cassette recorder, although it might take a few minutes to find the optimal settings. Once attached to the TV, it gives a rock steady display (more on that later).

Hardware

I have to say that I think it very pretty (our art director would probably beg to differ) — the casing even has go-faster stripes, which look suspiciously like ventilation slots in black and white photographs (coincidence, I'm sure). I would, however, have been happier with something rather more sturdy; ABS plastic might have done the trick, although perhaps at the cost of attractiveness.

The keyboard is most interesting; it's one of those waterproof, chemical proof, completely sealed units and it's stuck on to the main printed circuit board (PCB). Made of a special tough plastic, the undersurface is printed with the key symbols so as to eliminate any rubbing off. Between this keyplate and the PCB containing the metal contact strips (about five per key) is a piece of sticky plastic containing forty holes which line up with the "keys". This material is about .006" thick and is just sufficient to keep the metal underside of the keyplate away from the contacts, except when touched of course.

Typing gives a sensation of drumming your fingers rather than of doing anything useful. This is a totally mistaken impression because it really works rather well. For those who are interested, I found that a "wiping" action was more successful than the tapping movement usually associated with typing. Typists may be pleased to hear that the keys are in standard QWERTY layout although somewhat compressed compared to, say, the office IBM.

Looking inside the machine, I find that it's controlled by an NEC 780-1 processor chip . . . a copy of the well known and very successful Z80. This CPU, running at 3.25MHz, does all the work for the ZX80, including driving the TV and the cassette recorder. You'll notice that if any work is taking place, be it calculation, accepting input from the keyboard or driving the cassette, then the TV picture disappears — only to return when the activity is complete. This can be irritating to observers (at a demonstration for example) but I found it positively beneficial when keying in programs because it gave me positive feedback whenever a key made successful contact.

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The Sinclair ZX80 is innovative and powerful. Now there's a magazine to help you get the most out of it.

Get in sync

The magazine for Sinclair ZX80 users
SYNC

SYNC magazine is different from other personal computing magazines. Not just different because it is about a unique computer, the Sinclair ZX80 (and kit version, the MicroAce). But different because of the creative and innovative philosophy of the editors.

A Fascinating Computer

The ZX80 doesn't have memory mapped video. Thus the screen goes blank when a key is pressed. To some reviewers this is a disadvantage. To our editors this is a challenge. One suggested that games could be written to take advantage of the screen blanking. For example, how about a game where characters and graphic symbols move around the screen while it is blanked? The object would be to crack the secret code governing the movements. Voila! A new game like Mastermind or Black Box uniquely for the ZX80.

We made some interesting discoveries soon after setting up the machine. For instance, the CHR$ function is not limited to a value between 0 and 255, but cycles repeatedly through the code. CHR$ (9) and CHR$ (265) will produce identical values. In other words, CHR$ operates in a MOD 256 fashion. We found that the "=" sign can be used several times on a single line, allowing the logical evaluation of variables. In the Sinclair, LET X=Y=Z=W is a valid expression.

Or consider the TL$ function which strips a string of its initial character. At first, we wondered what practical value it had. Then someone suggested it would be perfect for removing the dollar sign from numerical inputs.

Breakthroughs? Hardly. But indicative of the hints and kinds you'll find in every issue of **SYNC**. We intend to take the Sinclair to its limits and then push beyond, finding new tricks and tips, new applications, new ways to do what couldn't be done before. **SYNC** functions on many levels, with tutorials for the beginner and concepts that will keep the pros coming back for more. We'll show you how to duplicate commands available in other Basics. And, perhaps, how to do things that can't be done on other machines.

Many computer applications require that data be sorted. But did you realize there are over ten fundamentally different sorting algorithms? Many people settle for a simple bubble sort perhaps because it's described in so many programming manuals or because they've seen it in another program. However, sort routines such as heapsort or Shell-Metzner are over 100 times as fast as a bubble sort and may actually use less memory. Sure, 1K of memory isn't a lot to work with, but it can be stretched much further by using innovative, clever coding. You'll find this type of help in **SYNC**.

Lots of Games and Applications

Applications and software are the meat of **SYNC**. We recognize that along with useful, pragmatic applications, like financial analysis and graphing, you'll want games that are fun and challenging. In the charter issue of **SYNC** you'll find several games. Acey Ducey is a card game in which the dealer (the computer) deals two cards face up. You then have an option to bet depending upon whether you feel the next card dealt will have a value between the first two.

In Hurkle, another game in the charter issue, you have to find a happy little Hurkle who is hiding on a 10 X 10 grid. In response to your guesses, the Hurkle sends our a clue telling you in which direction to look next.

One of the most ancient forms of arithmetical puzzle is called a "boomerang." The oldest recorded example is that set down by Nicomachus in his *Arithmetica* around 100 A.D. You'll find a computer version of this puzzle in **SYNC**.

Hard-Hitting, Objective Evaluations

By selecting the ZX80 or MicroAce as your personal computer you've shown that you are an astute buyer looking for good performance, an innovative design and economical price. However, selecting software will not be easy. That's where **SYNC** comes in. **SYNC** evaluates software packages and other peripherals and doesn't just publish manufacturer descriptions. We put each package through its paces and give you an in-depth, objective report of its strengths and weaknesses.

SYNC is a Creative Computing publication. **Creative Computing** is the number 1 magazine of software and applications with nearly 100,000 circulation. The two most popular computer games books in the world, *Basic Computer Games* and *More Basic Computer Games* (combined sales over 500,000) are published by Creative Computing. Creative Computing Software manufactures over 150 software packages for six different personal computers.

Creative Computing, founded in 1974 by David Ahl, is a well-established firm committed to the future of personal computing. We expect the Sinclair ZX80 to be a highly successful computer and correspondingly, **SYNC** to be a respected and successful magazine.

Order SYNC Today

Right now we need all the help we can get. First of all, we'd like you to subscribe to **SYNC.** Subscriptions cost **$10** for one year (6 issues), **$18** for two years (12 issues) or, if you really want to beat inflation, **$24** for three years (18 issues). Send to the address below or call our toll-free number, **800-631-8112** (in NJ 201-540-0445) to put your subscription on your MasterCard, Visa or American Express card. Canadian and other foreign surface subscriptions are **$15** per year or **$27** for two years. We guarantee your satisfaction or we will refund the unfulfilled portion of your subscription.

Needless to say, we can't fill up all the pages without your help. So send in your programs, articles, hints and tips. Remember, illustrations and screen photos make a piece much more interesting. Send in your reviews of peripherals and software too—but be warned: reviews must be in-depth and objective. We want you to respect what you read on the pages of **SYNC** so be honest and forthright in the material you send us. Of course we pay for contributions—just don't expect to retire on it.

The exploration has begun. Join us.

The magazine for Sinclair ZX80 users
SYNC

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ZX80, cont'd...

Technical Specification

CPU:	NEC 780C-1 (copy of Z80) 3.25 MHz
Memory:	1K static RAM, expandable to 16K
Keyboard:	Keyplate, under-surface printed
Screen:	Use own television. Pixel graphics 24 lines x 32 chars.
Cassette:	Use domestic audio cassette recorder.
Bus:	Edge connector with 44 lines — 37 from CPU, 0V, 5V, 9V, Clock, External memory indicator and two earths.
Software:	4K ROM containing Basic, Editor and Operating System

The Basic interpreter, operating system, character set and editor are all held in a 4K Byte ROM. If you are feeling adventurous there's no reason why you shouldn't pop your own ROM (TMS 2532) in its place.

Memory in the basic system comprises 1K static RAM; you can add to it via the expansion port, giving a maximum potential of 16K. The memory expands with the aid of plug in modules, each designed to carry up to 3K in 1K increments. Thus five modules would be required to give the 16K maximum. At switch-on the machine does a memory check which also tells the system how much memory is on-line. Should you reconfigure the memory, then the command NEW will execute the memory check cycle again.

Moving on to the "outside world" connections, there's a cassette interface, TV socket and a hefty edge connector. The cassette interface comprises two 3.5mm jack plug sockets, securely mounted on the main (and only) PCB. One connects to the "ear" socket on the cassette recorder and the other to the "mic" socket. There is no facility for remote control of the cassette motor.

Although I encountered one or two problems at first, once working, the cassette interface proved trouble free. My particular recorder had a nasty habit of recording noises when the CPU was "sending out" silence. This caused the system to get its knickers in a twist when reading from cassette because it expected silence just before the file header record. After a couple of hours (what a confession) the culprit was found — the "ear" lead, which acts as a monitor while recording, was setting up some sort of oscillation. Answer — simple — disconnect the "ear" jack when recording. Another tip which ensures trouble free loading is to move the tape into the silent section before issuing your LOAD instruction. Rumor has it that the cassette operates at around 250 baud — I believe it, although it doesn't seem terribly important when you're only loading the 1K that I was.

The television connector is simplicity itself. Plug one end of the cable (supplied) into the ZX80 and the other into the television aerial socket, tune to channel 2 and you're in business. The display is magic; rock steady and very clear although reversed characters (white on black) are not so good.

I have already mentioned the business of the display switching off every time the processor needs to do something else. If this drives you mad then you'll have to forfeit some of the undoubted pleasures that this machine has to offer. The screen is not memory mapped; it's treated like a serial file — like a printer in fact — which means that fast moving graphics are out of the question. No doubt some clever Dick out there will take up the challenge and fudge the system, just to prove me wrong. More about the reasons for this in the Software section, but anyone who is hooked on white characters on a black background can suitably modify the PCB, though why they should want to I'll never know. It's a matter of cutting one track and making a small bridge to another.

Do you take your computer camping with you? You'll be pleased to hear that it can run from a car battery, provided that the lead regulates the supply. I believe you can buy a cigarette lighter plug with a built in regulator . . . couple that with a portable TV and a battery powered cassette recorder and you'll be the envy of the campsite.

> **The keyboard is most interesting; it's one of those waterproof, chemical proof, completely sealed units.**

Now let's look at the hefty edge connector. This is where the memory expansion modules fit in, each one being "piggy backed" on the one previous. Thus there are always 44 contacts available for outside use. There are 37 lines drawn from the CPU plus 3 power lines (at 0V, 5V and 9V); the other lines comprise two grounds, a "clock" signal and an "external memory in use" indicator.

All in all, the Sinclair ZX80 is a well designed, well produced personal computer. Memory addition comes a bit expensive at about $700 for the full expansion but Clive Sinclair tells me bigger RAMs are on the way — that means cheaper expansion when they appear.

I'm sorry that there are no pictures of the machine's innards. The fact of the matter is that I was given one of the development machines which had a couple of "Veroboarded" EPROMS and a selector IC floating around on the ends of some pieces of wire which in turn were soldered into the "official" ROM socket. I thought it best to spare Mr. Sinclair's blushes.

Software

The software of the ZX80 comprises the Basic interpreter, the Editor and whatever it is that does the rest of the work (Operating System seems too grand a title). Rather than looking at each separately, I shall examine them in the order they might be encountered.

First of all the keying in of programs. For two reasons it's an absolute joy! First you don't have to type in many of the Basic instruction codes, one key is sufficient; second you cannot enter anything that is syntactically incorrect. Some Basic instructions have to be entered the long way (these are listed above te keyboard) but 29 of the instructions may be entered with a single keystroke, while only 8 need to be keyed in full.

As with many small computers most of the instruction codes are stored in a single byte. Normal Z80 machine code can be entered using the POKE statement and executed with the USR instruction. This should keep the buffs happy after they have tired of Basic. Syntax checking is superb — it's impossible to go wrong. Every character is checked on entry and, if the interpreter thinks that you are going to make a mistake, it signals with a reverse S (for Syntax) at the point it thinks you have gone wrong. If, later in the same line, you correct the error, then the marker disappears. What a grown up facility for such a small machine! Incidentally, the program lines are displayed very clearly with line numbers, instructions, operators and what have you being nicely spaced out.

Inside the memory, however, there's a completely different story. The lines of code are held as compactly as possible with most of the commands and operators occupying one byte each. The spaces are removed and there are very few extra bytes needed — for instance the new line code is one byte, although I did notice that the "=" operator needed one extra for some reason. I'm sure there are others, but I'm equally sure they are very few and far between. An example of the storage requirement is as follows:

```
10 FOR A = 16424 TO 17424    18 Bytes
20 PRINT PEEK(A);            12 Bytes
30 NEXT A                     5 Bytes
40 STOP                       4 Bytes
```

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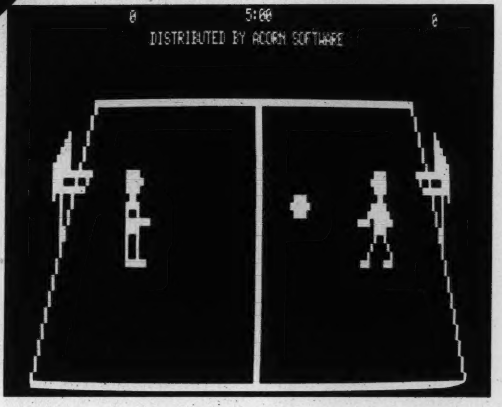

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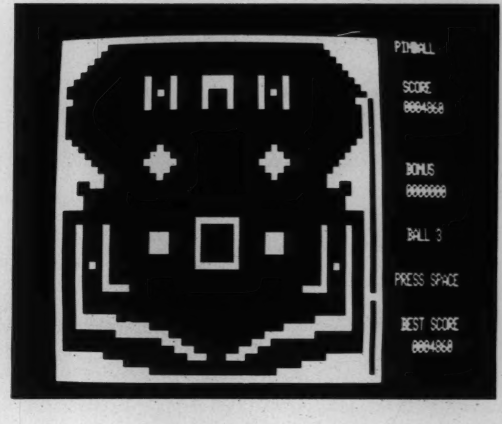

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ZX80, cont'd...

So you see, the storage for that program (displaying the 1K memory) is 39 bytes long — an average of 10 bytes per instruction. I'll leave you to work out what sort of program you can get in 1K. Perhaps I should mention that the screen buffer uses part of the 1K, as does the stack and system control area. The stack is held at the top of memory and "grows" down; I put 327 entries on it before it stopped accepting them.

The program and variables "grow" up into the screen buffer thus reducing the amount of data on display. Eventually it's possible for the program or variables to grow so large that there's nothing left on display. It was while experimenting with this interesting feature that I crashed the system. It seems the software couldn't cope with someone entering a string 868 bytes long! After about 424 bytes of input the screen removed another character every time I keyed in a new one — it was most odd to watch.

Another way of crashing the system, in fact the only other way I could find, is to hit the EDIT key while in the middle of an INPUT loop. This returns the current program line with a syntax error which is impossible to clear. For those who are feeling unhappy about all this talk of crashing systems, don't worry, it's not as bad as it sounds. In the first place you have to enter forty characters after the screen has gone blank, and in the second place you can only hit EDIT when you are also holding the SHIFT key down.

Now it may be that, having loaded your program, you wish to edit it. Well once again there is some rather excellent software to help you. The Editor enables you to move a "current line marker" up and down the program text. Wherever it is you will always be able to see the marked line and at least some of its neighbors (it's called getting it in context). Pressing the HOME key causes the marker to disappear — it has in fact gone to an imaginary position, one above the first program line. Having reached the line to be edited press the EDIT key and the line will be presented at the bottom of the screen ready for you to do your worst. From now on it is as if you are entering the line for the first time.

The benchmark* timings show the ZX-80 to be very fast, even though I had to introduce some extra code to make some of the instructions work. Specifically I had to bracket expressions like LET A=(K/K)*K)+K—K . . . if I hadn't, the expression would have exceeded the ZX80's capacity. The machine can only operate on integers and these must have values from —32768 to 32767. I couldn't execute Benchmark 8 because the machine has no logarithmic or trigonometrical functions built in.

Basic

String Expressions			
CHR$(n)	TL$(s)	STR$(n)	
Integer Expressions			
PEEK(n)	CODE(s)	RND(n)	USR(n)
ABS(n)			
Statements			
NEW	LOAD	SAVE	RUN n
RUN	CONTINUE	REM	IF n THEN stmnt
INPUT dest	PRINT	LIST n	LIST
STOP	DIM (n)	FOR =n TO n	GOTO n
POKEn,n	RANDOMIZE n	RANDOMIZE	CLEAR
CLS	GOSUB n	RETURN	NEXT
Operations			
n**n	— n	n*n	n/n
n+n	n — n	n = n	n > n
n < n	s = s	s > s	s < s
NOT n	n AND n	n OR n	

n = number
s = string
** = to the power of

Finally, it's possible to save programs and any variables associated with them. If you want to make use of those same variables when reloading the program, use GOTO rather than RUN. Although it's possible to SAVE programs in this way, no provision has been made to save files — yet.

> **Every character is checked on entry.**

That's about it for the software; once again, considering the size of machine and price, I think that it's not at all bad.

Basic

The ZX80 Basic has been well thought-out and, while it lacks some of the elegance and sophistication of the bigger machines, it's a very usable version of the language.

The main limitations relate to file handling and mathematical functions. File handling facilities don't exist, except by SAVEing the whole of memory (which is probably not as daft as it sounds). It does mean that you can save a program with all its variables, reload it the next day, remember to kick off with a GOTO rather than RUN, and carry on from where you left off. On the small memory machine it doesn't seem that important, but on the larger memory machines it means you can hold some reasonable sized files together with your program.

Benchmark timings (in seconds)	
BM1	1.46
BM2	4.69
BM3	9.18
BM4	8.95
BM5	12.7
BM6	25.9
BM7	39.2
BM8 not performed (see text)	

The mathematical limitations are possibly more serious. The fact is the Basic can only handle integers in the range — 32768 to 32767, no decimals, hence the programmer must write a little routine for each mathematical function that requires decimals to be used. This should pose few problems for those with the larger memory machines but it will undoubtedly occupy a fair chunk of the basic 1K system.

So much for bad news; now here are some of the good features of the language.

Taking numeric functions first, the Basic offers up to 26 single dimension numeric arrays of any length. It also allows three Boolean operations — AND, OR and NOT.

The randomizing functions are worth a mention. RANDOMIZE n sets a seed value, while RND(n) gives a random number in the range 1 to n. PEEK and POKE are both available so it's possible to read or modify memory contents; coupled with the USR function, this means that Z80 machine code routines can be executed.

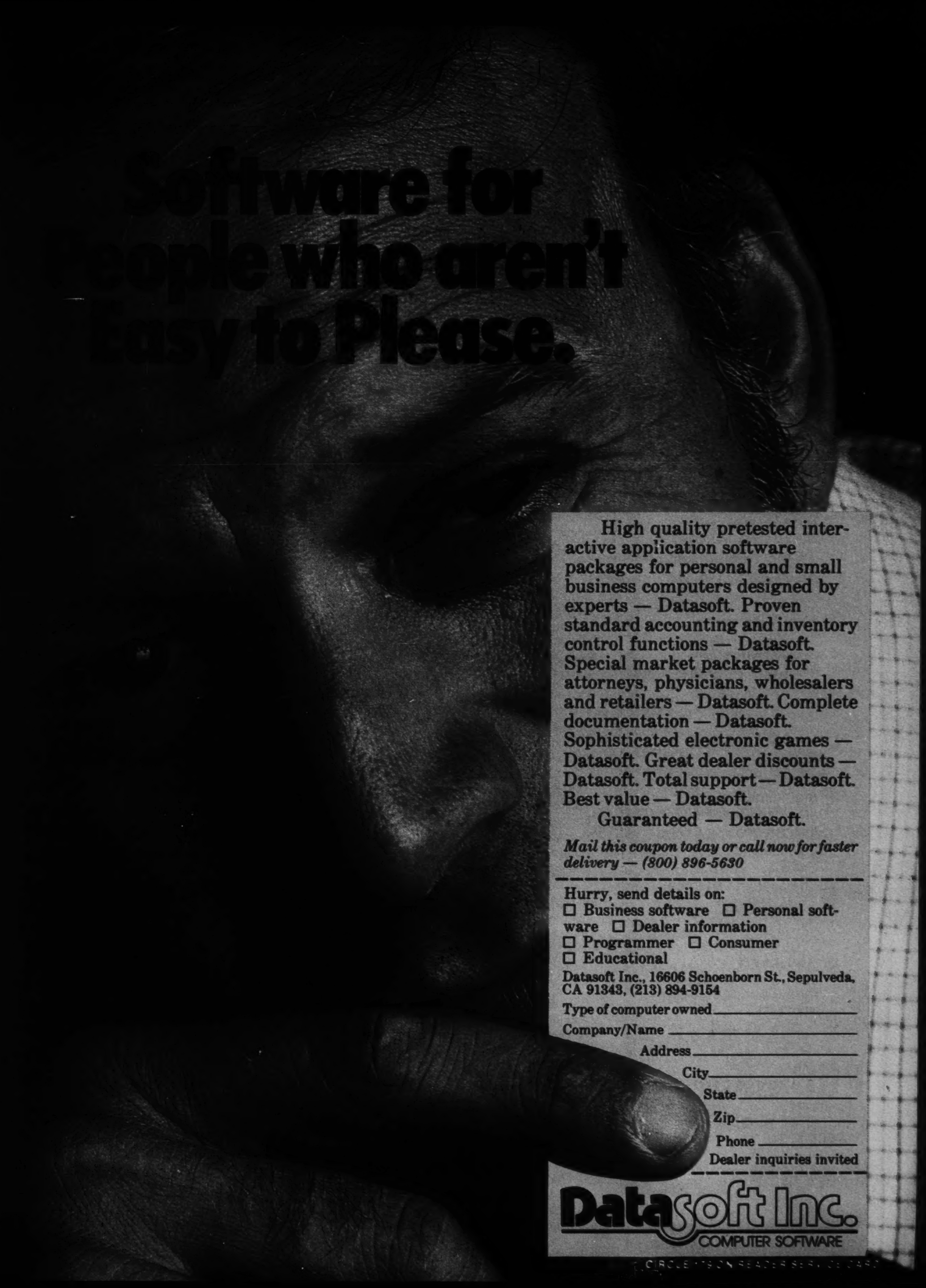
Up to 26 FOR . . . NEXT loops can be nested and the number of nestable subroutine calls seem to be dictated by the amount of memory available to the stack. On the 1K machine with a short (4 line) program, I ws able to get 327 subroutine calls in before needing to RETURN.

String functions, while adequate, could definitely be improved. The absence of a DATA statement and the lack of string arrays caused particular frustration. Although there are ways around these problems, they can be time consuming and messy.

The functions which are available, and which form the building blocks of string handling subroutines, are STR$, TL$, CODE, CHR$ and INPUT. STR$(n) returns a string of 1 to 6 characters representing the signed, decimal value of n. TL$ returns a string minus its first character, while CODE returns the code for the first

---

*PCW uses 8 Benchmark programs to compare computers.



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ZX80, cont'd...

character in a string. CHR$(n) represents the character whose value is n and INPUT allows the operator to input numeric or alphanumeric information. A nice touch is that if the destination of input is a string variable, then the Basic kindly provides a pair of quotes which act not only as a prompt, they also save a little bit of keying.

There is one trap here for the unwary, and I fell into it. I had this nice little loop going and after a while I got fed up with it. Could I get out of the system — could I heck! I hit everything in sight but all I managed to do was crash the system (see earlier). The trick is that if you are in an input string loop, remove the quotes and then put in an arithmetic expression which will resolve outside the range — 32768 to 32767.

So, that's the Basic — I reckon that it's pretty good under the circumstances and in some respects I prefer it to the Basics that do all your thinking for you.

Documentation

This comprises a programming cum operating manual. It's very well presented, being written by Hugo Davenport of Cambridge Consultants, with appendices by the mystery man from Cambridge who wrote the Basic interpreter. There are a few small mistakes in the manual — none of them terribly serious and all of them being dealt with before the next reprint. It's probably good enough to learn to program from it and my only real criticisms like in the area of what it does (or rather, doesn't do) for the raw beginner. I lent the machine to one such person for a few hours and here in his reply regarding the documentation:

"I read Chapter 2 (Getting Started) and got completely lost by the third page. One minute it's telling me how to wire everything up, the next there's something incomprehensible about storing programs on tape. I couldn't find an 'Idiot's Guide to getting started' anywhere."

Maybe the Operating Manual wasn't designed with such a person in mind — even so, novices like him must surely represent a good sized chunk of the ZX80's ownership potential."

Future Plans

A new ROM is being developed which will overcome most of the shortcomings of the existing system. Being 8K instead of 4K means that file handling routines will enable us to read and write tapes — even discs! This new ROM will also include the missing trigonometrical, logarithmic and floating point arithmetic functions.

Another area of development is on the memory front. A 16K plug in dynamic RAM is a distinct possibility; this will be considerably cheaper than taking the present $700 expansion route. A printer is also likely to appear in due course.

Potential Use

In its present form the ZX80 offers an ideal introduction to computing. It makes Basic easy to learn, it's small enough for it not to be intimidating and it's cheap enough that, should you decide computing is not for you, you can give it away, sell it or whatever. Indeed it's probably cheaper to learn Basic this way than to pay for many of the courses around.

Teachers might buy it for their students' use because at the price there is no need to go through a complicated rigmarole to get the money. The 1K version can be used for fairly simple games and activities, although it's likely you will want to expand it before very long. Later, when the file handling facilities are introduced together with floating point arithmetic, I think the machine will become really useful, though still very much at the personal level. Home accounts and engineering calculations spring to mind immediately — don't ask me why! Suddenly the machine becomes something more than a teaching machine or toy: it starts to become a real computer.

Conclusion

Having just read Science of Cambridge's claims for the machine again, I have to say I agree with most of them. The only point I would question is that it offers high resolution graphics. OK, OK, so they are playing the same game as everyone else . . . all the same I feel that it should be explained. Just lately, people have taken to calling pixel graphics, high resolution graphics. Accordingly, what used to be called high resolution graphics now has to be called ultra high resolution graphics. To put it another way, the ZX80 offers a graphics resolution of one quarter of one character, plus you must write your own software to be able to use it. PET is in exactly the same boat, unless you want to buy the high resolution add-on at about $600.

The ZX80 appears to be a well thought out machine both in terms of hardware and software. It has an excellent editor and interpreter which between them help you avoid all sorts of nasty pitfalls. The Basic instruction set lacks one or two fairly important facilities — namely file handling and floating point calculations. Despite this, it's still a fine machine on which to learn about computing. The new ROM expected later this year will overcome the prime limitations leaving me very little to say except that I hope Mr. Sinclair and his merry men of Cambridge can cope with the expected flood of orders and, perhaps more importantly, the after sales service which is vital in this sort of operation. ☐

Our thanks go to Clive Sinclair for lending us the machine, and to Jim Westwood (its designer) for patiently answering so many questions.

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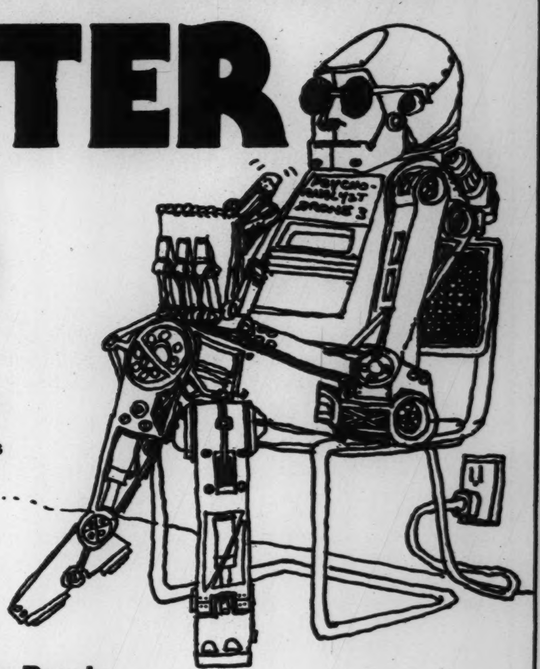

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SOFTWARE PROFILE

Bridge Challengers

Stephen Kimmel

There are at least ten people who play bridge for every chess player in America. It is probably fair to say that while bridge is played by socially active adults, the average chess player abandoned chess when he discovered sex.

Appropriate howls and screams from the chess delegations. . .

Consider. Bridge is a social game, requiring at least four people, frequently involving eight or more. Chess is a brain teaser requiring only two humans or one human and one of the better computer chess players. Bridge requires that the players talk to each other. Chess prefers silence. Bridge has natural breaks that occur every five to fifteen minutes that encourage conversation and socializing. Chess may require four or five hours of intense concentration. Bridge is a game. Chess is armed combat. Bridge can be fun. Chess is like morning calisthenics.

Why are there dozens of chess programs on the market and only two bridge programs? First, personal computers and chess are related activities in that both require concentration and intense mental activity. As such, both are essentially antisocial. You leave your wife and kids, close the door and kill klingons. Or you can seal yourself behind a wall of concentration in a chess game. Neither activity lends itself to socializing.

The second reason is more telling, in my opinion. The chess experts have always agreed that it was theoretically possible for a computer to play acceptable chess. The bridge experts have never made that concession about their game. With chess, all of the information is always available to all of the players all of the time. From a given position in a chess game there are a limited number of moves. While bridge also has a limited number of moves, at least half of the information is hidden all of the time. This key difference, the dealing with certainties versus dealing with unknowns, is what separates the two games.

The problem with bridge is that you need at least four players. Three simply won't cut it. The ideal computerized bridge player would be the extra player you needed. It would know all the major bidding conventions. It would play well on offense and passably on defense. If possible, it would read regular cards. It would be a robot that could sit at the table with three humans and hold its own. Of course, it would keep score.

There are two products on the market that play computerized bridge. Curiously, they are both named Bridge Challenger.

After shuffling the cards, you feed the computer's cards over a built-in optical scanner, where it reads the bar codes marked on each card.

Bridge Challenger is a product of Personal Software, written by George Duisman in Basic. It sells for $14.95 and comes in versions for TRS-80, Apple and Pet. Personal Software are the same people who brought you Microchess. (Personal Software Inc., 1330 Bordeaux Dr., Sunnyvale, CA 94086.)

Bridge Challenger, on the other hand, is a dedicated computer produced by Fidelity Electronics of Miami, Florida. At about $300, it costs slightly more than *Bridge Challenger*. Fidelity are also the manufacturers of Chess Challenger and Backgammon Challenger (Fidelity Electronics, 8800 Northwest 36th St., Miami, FL 33178.)

When I started this project, I thought I'd play them against each other the same way we did in the Creative Computing Computer Chess Tournament. That way I hoped to determine which played the better bridge. Unfortunately, that was impossible.

Personal Software's Bridge Challenger

Imagine if you will a football program designed to simulate the Super Bowl in which you were always the Pittsburgh Steelers while the Computer was always the Los Angeles Rams. Imagine further that the Steelers are always on offense and never play defense. And that they always start their drives on the fifty yard line. That the Rams don't play defense very well and that the computer can't keep score. You'd probably say that the program was incomplete and far from satisfactory.

Personal Software's *Bridge Challenger* has no provision for bidding, so it is missing a substantial portion of the game. It doesn't keep score. It only plays defense, and doesn't play that very well. As an extra bridge player the program is completely unsatisfactory.

What does that leave for the P.S. *Bridge Challenger*? The play of the hand is one of the interesting portions of the game. There are lessons to be learned by simply playing out the hand. Perhaps there is a place for *Bridge Challenger*: something to practice bridge against.

I tried it against a number of humans to test their reactions to it. My experienced bridge players found it laughably inadequate; my inexperienced bridge players (just learning or less than six months of active bridge playing) found it a moderate challenge. One stated that the only hands he had problems with were ones that he had fouled up. My totally naive bridge players couldn't get interested in the program at all.

Bridge Challenger does follow suit. Its defense is mediocre at best and it frequently will enable a player to make a bid

---

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Bridge, cont'd...

by overtaking a trick it has already taken. Personal Software's *Bridge Challenger* gets half a star and a don't-bother recommendation. (Considering Personal Software's marketing procedures, the program will probably never get much better.)

Fidelity Electronic's Bridge Challenger

Fidelity Electronics has come much closer to the goal with their Bridge Challenger. I recommend it — if you can find one, that is. Fidelity had production problems and were unable to meet the demand last Christmas. We bought the last one available in Tulsa, America's 43rd largest city.

Physically, the Bridge Challenger is everything you'd want it to be. Nice solid appearance, easy-to-understand instruction book, a nice carrying case. Everything is essentially the way you would design it if you were working from theory. Physically.

Sometimes, however, Bridge Challenger makes bizarre mistakes.

The Bridge Challenger comes with three felt pads where it "holds" up to three hands. After shuffling the cards, you feed the computer's cards over a built-in optical scanner, where it reads the bar codes marked on each card. That way it can play with real people. Some people have reported having difficulty getting the machine to read the cards. It appears to be a matter of speed and touch. I had no problems with it but my bridge expert never did get the hang of it. Fidelity should probably put in some mechanical means of feeding the cards past the scanner at the correct speed.

The Programming

In retrospect, Fidelity introduced this product in the same state of development as the original Chess Challenger. The unit played chess at the novice level. To Fidelity's credit, they are never satisfied with their products and are constantly working to improve them. The current Chess Challenger plays excellent chess. If Fidelity repeats its performance with the Bridge Challenger it will be a good product next year and a terrific product the year after that. And the price will probably be down to $100. Preliminary reports on the next model are very favorable. As for the current model. . .

Bridge is a two-part game. First, all four players bid until one partnership wins the contract. The contract establishes how many tricks the leading partnership must take, and what suit is trumps. In bridge, you only score points that count toward game if you bid and make your contract. The bidding portion of the game is almost more important than the playing of the hand. If you consistently end up in the wrong contract, you won't win no matter how well you play the cards.

Bridge Challenger's bidding is generally adequate. Experts might quibble over many points of the bidding but normally it ends up in the right contract. Sometimes, however, Bridge Challenger makes bizarre mistakes. Consider this hand:

NORTH (CHALLENGER)
S.10,6,4,3
H.K,7,6,3
D.A,10,8,6,4
C. -

WEST	EAST
S.8,5,2	S.Q,9,7
H.J,10,5	H.Q,9,8
D.5,2	D.Q,J
C.J,7,5,4,2	C.10,9,8,6,3

SOUTH (CHALLENGER)
S.A,K,J
H.A,4,2
D.K,9,7,3
C.A,K,Q

Bidding:

SOUTH	WEST	NORTH	EAST
2NT	Pass	3D	Pass
3H	Pass	4H	Pass
3S	Pass	4C	Pass
5C	Pass	6D	Pass
Pass	Pass		

The computer enters the Gerber convention by bidding 4C over the bid of 3S. Except that three spades isn't a legal bid after a bid of four hearts. Although four clubs is all right after three spades, it isn't legal after four hearts. Bridge Challenger misinterpreted the bids, ended up in a hopeless contract and went down badly.

Or consider this hand:

NORTH (CHALLENGER)
S.7,6
N.K,J,2
D.9,6,5,2
C.A,K,7,4

WEST	EAST
S.K,3	S.5,4,2
H.10,8,7,6,3	H.A,Q,9,5,4
D.K,8,4	D.A,7,3
C.8,5,3	C.10,9

SOUTH (CHALLENGER)
S.A,Q,J,10,9,8
H. —
D.Q,J,10
C.Q,J,6,2

Again Bridge Challenger is North and South and this time it is vulnerable — a condition that seems any too likely to happen.

The bidding in bridge is communication through the restricted language of the bidding. Each partner describes his hand in these terms. When that communication is fouled up, it is very fouled up. This hand is a laydown in four spades. but how did Challenger bid it?

WEST	NORTH	EAST	SOUTH
Pass	Pass	1H	2S
Pass	2NT	Pass	3C
Pass	4C	Pass	4H
Pass	5C	Pass	5S
Pass	6C	Double	Pass
Pass	Pass		

With only 24 high card points between them, North and South should give no real consideration to game in Notrump or in a minor suit. Slam is completely out of the question. South's first bid says "I have a powerful spade suit and an opening hand." North, having already said he doesn't have 13 points says, "I've got powerful little and it is spread out." South should say 4S saying, "Okay, I'll go it alone." Instead South says "My only other biddable suit is clubs." North responds, "Well hell, we may have

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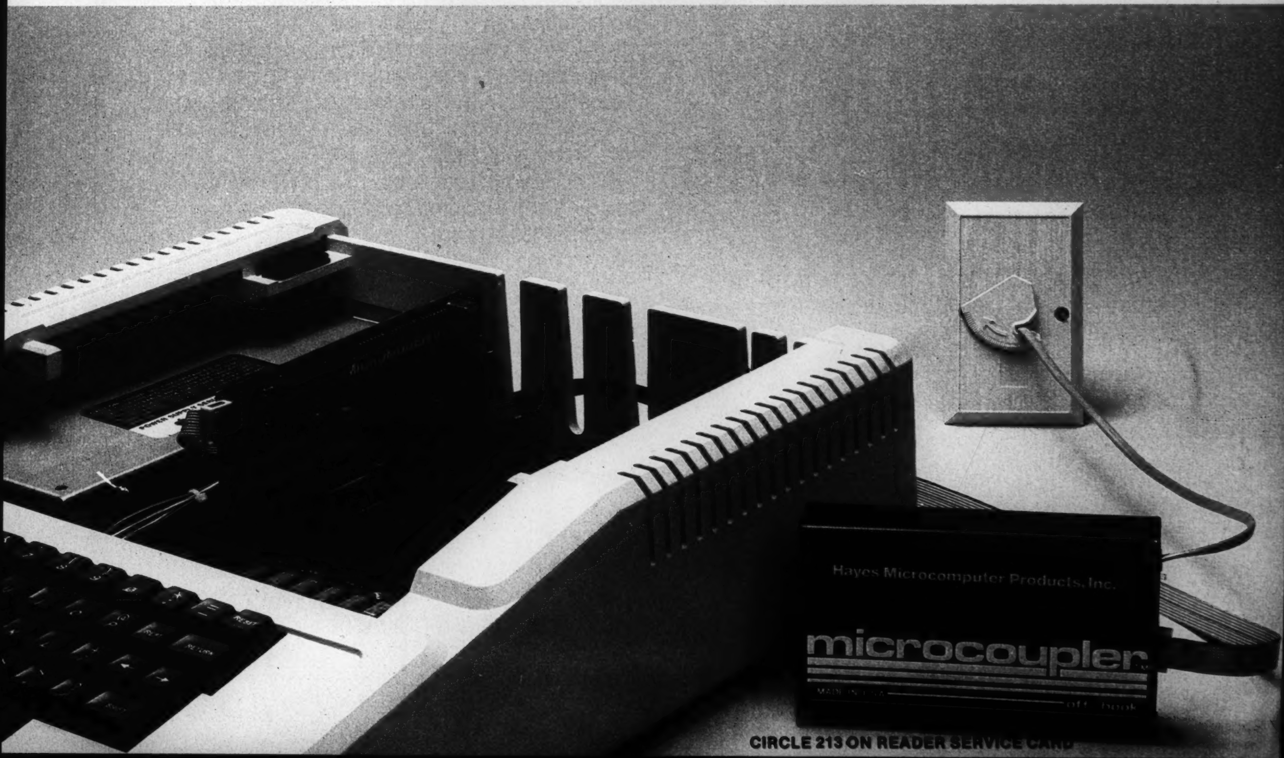

CIRCLE 213 ON READER SERVICE CARD

Bridge, cont'd...

a chance at Slam. How many aces do you have?" Or perhaps North is saying, "Yes I have clubs too." South says, "I only have one ace, partner. You figure out how many we have between us." North says, "Yes, I have clubs." South says, "Are you crazy? If you have that many points? Why didn't you open?" I don't have any Kings." North responds, "I have clubs. We have two aces out against us and two kings. Let's play this in clubs." East jumps in now and says, "Ain't no way." South says, "I give up. Who dealt this?"

Almost any contract in clubs is impossible, much less slam. East/West take two diamond tricks, one spade and two heart tricks to win more points than the game was worth.

There are some bad bugs in the bidding portion of the program. They seem most apparent when the machine makes mistakes and when it is bidding slams. One hopes these will be corrected shortly. Until they are corrected, they render the value of the unit minimal at best.

Fidelity's advertisements say, "Superb playing ability. . ." Uhhhhh.

The Bridge Challenger has gotten a lot of bad press lately in the bridge magazines. almost all of it has been directed toward Challenger's poor playing ability. Fidelity has recently stated that the Challenger has "a beginner's play of the hand." That is just about right.

The current Bridge Challenger almost always draws trumps and almost never finesses. It will only finesse if the opportunity presents itself. It will not set up a finesse. Considering how poorly it does finesse when it does try one, it might be better off not trying. However, it does maintain transportation between the declarer and the dummy, which is better than I do sometimes. defense is much more difficult to play well, and Bridge Challenger seems to do all right — although it discards tend toward the stupid.

If Fidelity repeats its performance with the Bridge Challenger it will be a good product next year and a terrific product the year after that.

What is the verdict, then? Forget Personal Software's *Bridge Challenger*. It is too slow — a bridge program should be written in assembler, not Basic — too limited, and too mediocre to consider seriously. There is no realistic prospect that it will get better.

Although I originally hoped to give Fidelity's Bridge Challenger a good review, I'm afraid that this will be a mixed review at best. The device has been crucified in the bridge magazines. *Popular Bridge* stated that the Bridge Challenger was "worthless at any price. . . *Popular Bridge* accepted the first advertisements for the Challenger in good faith, relying on the technical ability of a firm that had produced a good chess and backgammon robot. *Popular Bridge* will accept no further advertisement of the Bridge Challenger." The Contract Bridge *Bulletin* was only slightly more graceful. One magazine went so far as to request its advertisers to stop selling the Challenger.

On the other hand, my local Sears sold out of them and has reported that none of them have been returned by dissatisfied customers. The Sears people went on to tell me that they guarantee customer satisfaction or money back. Obviously there are a lot of satisfied customers out there.

My recommendation is that you wait until the next model comes out. Or better yet, the next model. That one should really be worth the money. Until then . . . well . . . With some more work the Fidelity Bridge Challenger will be a fine product. □

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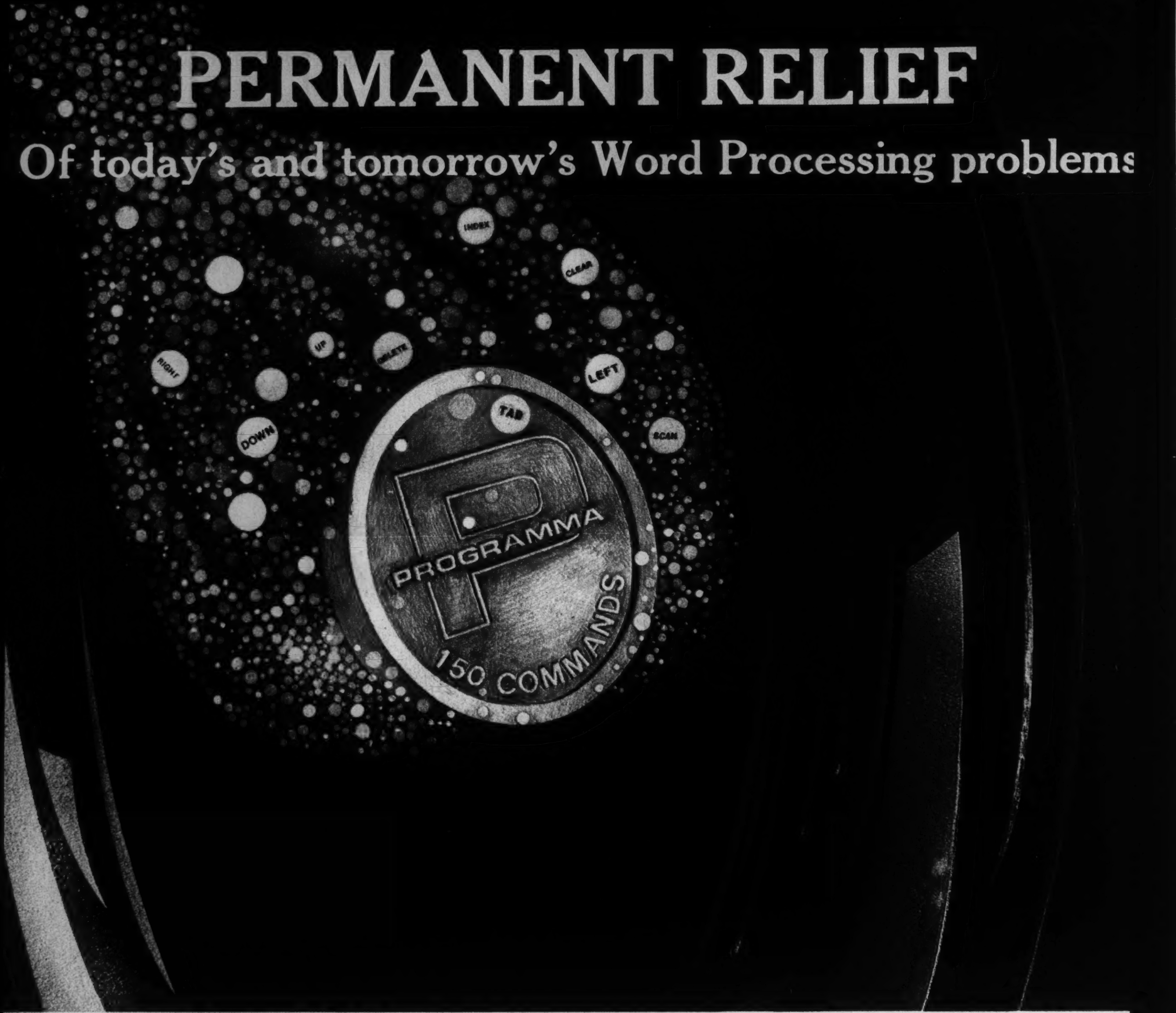
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Apple Pascal

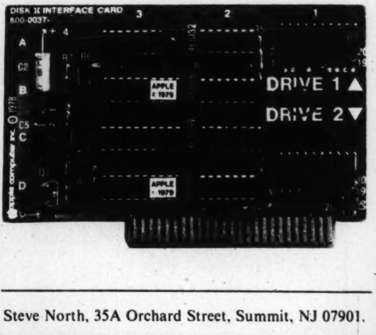
Steve North

For the last several months I have been using the Apple/UCSD Pascal system, and I'd like to share my impressions with you.

To run Pascal on the Apple II, you must plug in a Language System board in slot 0, and insert a 16-pin jumper into a memory chip socket. This allows the 48K Apple to think it has 64K of RAM, or to switch back to normal mode (with Basic in ROM). You must also replace your old disk bootstrap ROMs on the disk controller card to accommodate the higher-density disk format Pascal (and the new Basic DOS) use. After replacing the disk-boot ROMs, you can directly boot Pascal or DOS 3.3, and can convert old Basic disks to the new format or boot them by a two-step process. One should reasonably have at least two disk drives to run Pascal.

Apple Pascal is not only a language compiler, but a complete operating system with utilities and libraries. It is screen-oriented (with lots of paging instead of scrolling) and meshes in a pleasing way with the Apple's graphics, sound effects, game paddles, and plug-in I/O cards. However, this monolithic style of software design — making one giant self-contained system to Do It All — can be more restrictive than very open-ended designs incorporating many very small (sometimes disposable) software tools. (While there are no absolutes, CP/M follows this philosophy much more closely, and this helps explain why it is so popular and there is so much CP/M compatible software.) Certainly Apple Pascal presents the user with a much more integrated view of the system, but at a price.

Pascal is easy to learn and almost forces one to write logical, readable, understandable programs.



Steve North, 35A Orchard Street, Summit, NJ 07901.

The Choices

When Pascal is booted, it displays a menu of commands, each activated by a single keypress. The following are available:

E) Edit a file. The editor is screen-oriented — you have a cursor you move around within the file to do insertions, changes, and deletions — but it is more slanted toward program development than letter-writing. For example, it has an auto-indent mode to encourage the writing of structured programs, and it can also be told to discriminate between quoted text and Pascal code. The editor and the rest of the system can default to a "current work file," which is very convenient for sessions of editing, compiling, and debugging.

F) File system. This subsystem gives you access to another set of commands for listing directories, copying files, testing for bad disk sectors, scrunching free space on disks, and the like. Disks can be accessed symbolically (by a name like GAMES or XYZ98) rather than by physical device number, a feature that would be welcome in other systems. The operating system is also smart about allowing you to change disks (and even asks you to do it when necessary), unlike other operating systems which throw up their hands in despair when disks have been changed without rebooting.

C) Compile. The compiler is the heart of the Pascal system. The compiler and library incorporate almost all of the stuff in the Jensen and Wirth *Pascal User Manual and Report*, and adds some very welcome extensions, such as Logo-like turtle-graphics, without any kludging. ***(Editor's note: "turtles" are hypothetical reptiles with pens in their beaks that rotate and crawl on the screen under program control.)***

Pascal itself (as a language, not speaking of any implementation in particular) is a very nice, cleanly designed language for both simple and complex programming. Designed by Wirth in Europe, some Americans found it Teutonic and restrictive. Its only major competitor for this kind of programming on personal computers is C, another "structured" language. Most compupeople seem to agree that C is a somewhat more powerful language than Pascal, especially for systems software writing, but it is harder to

No. 17½

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- -

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Hearty Appetite.

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† Recommended system configuration consists of 48K CP/M, 2 full size disk drives, 24 x 80 CRT and 132 column printer.

Ⓜ Modified version available for use with CP/M as implemented on Heath and TRS-80 Model I computers.

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BASF System 7100	RD
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Blackhawk Micropolis Mod II	Q2
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iCOM 4511 5440 Cartridge CP/M 1.4	D1 #
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IMSAI VDP-42	R4**
IMSAI VDP-44	R5**
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Intecolor	See ISC Intecolor
Intel MDS Single Density	A2
Intel MDS Double Density	A5
Intertec SuperBrain DOS 0.1	R7
Intertec SuperBrain DOS 0.5-2.X	RJ
Intertec SuperBrain DOS 3.X	RK
ISC Intecolor 8063/8360/8963	A1
Kontron PSI-80	RF
Meca 5¼"	P6
Micromation (Except TRS-80 below)	A1*
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Quay 500	RO
Quay 520	RP
RAIR Single Density	R9
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REX	Q3
Sanco 7000 5¼"	RQ
SD Systems 8"	A1*
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TRS-80 Model I + Micromation	A4*
TRS-80 Model I + Omikron 5¼"	RM
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Apple Pascal, cont'd...

learn and allows one to get in trouble much more quickly. Pascal is easy to learn and almost forces one to write logical, readable, understandable programs. (Of course, you could also get C up on your Apple by buying the BD Software or Whitesmith's C compiler for the Z-80 along with a Microsoft Z-80 Softcard, but that's another adventure of dubious merit for another article.)

The Compiler

The compiler recognizes the data type STRING, not really in the original Pascal specification (a blunder), which is the same old array of characters that standard Pascal has, but with a length attribute magically tacked on. Compile-time toggles allow you to turn on/off the checking of I/O errors (why would you want to turn them off?), range errors, and the internal swapping of the compiler. the user can include an externally stored text file with special routines or definitions in it.

Anyway, we should mention in passing that the compiler handles errors more gracefully than ANY OTHER we've tried, by allowing you to jump immediately into the editor with the cursor over the offending code, and a description of the problem at the top of the screen. The compiler also generally finds where the error really is, which isn't always easy to do.

The compiler handles errors more gracefully than ANY OTHER we've tried, by allowing you to jump immediately into the editor with the cursor over the offending code.

R) Run a program. This causes the current workfile to be compiled (if necessary), linked (if necessary), and executed.

X) This command executed a named code file (output of assembler or compiler).

A) A 6502 assembler with many juicy pseudo-ops is also included in the package. Subroutines in 6502 machine language can be called from Pascal.

L) The linker can be explicitly called by the user for user-written non-standard libraries.

Gripes

Since there is no debugger in the Pascal system, fixing programs is done the horrible way, by inserting WRITE statements all over the place to try to decipher what's happening. Debuggers for high-level languages are usually primitive at best, but it's sometimes helpful to be able to look at the stack or see a traceback or set breakpoints. Another moderate annoyance is that Pascal wants to run on an 80 column screen, and the plain-old-vanilla flavored Apple II has only 40 columns (whereas the space-age Apple III has 80 columns). The attempted solution for the Apple II was to split the 80 column screen into two imaginary 40-column screens and then you can either flip back and forth between them or scroll horizontally. This technique works OK but if it bothers you, it is also possible to connect an external terminal or use an 80-column video card. This links us to another minor problem — the Pascal system is a bit fussy about talking to non-Apple I/O cards (in particular it did not recognize the SSM Apple RS-232 I/O card which entailed great fussing with user-written I/O drivers).

The documentation is good, but a few items fell between the cracks. In particular, there did not seem to be any specific information in the reference manual on how parameters are passed to assembly language subroutines. Also, the documentation on what's happening in the system at the nuts and bolts level is missing (perhaps for proprietary reasons).

For those curious about details of the implementation, Apple/UCSD is a "portable" (a little bit) compiler which is apparently reworked Zurich p-code. That is, the compiler and operating system and everything else wonderful but not Apple-dependent is written in a machine language for a hypothetical stack architecture processor, which is simulated by the 6502 in the Apple. This might sound inefficient but the p-machine is highly optimized toward running Pascal object code and thus is very reasonable in its use of time and memory.

Overall, Pascal is a very very nice language, and this is a very very nice implementation. If you're a teacher, and have an Apple, perhaps you should be teaching your students Pascal instead of Basic, which encourages bad programming practices and looks backward, not forward. If you're a personal computer user, you'll find Apple Pascal to be fast, powerful, and a pleasure to use. Absolutely get one of these if you can afford the $500 list price. □

What a P-Machine Is

Since good computer software is so difficult to develop it's worthwhile to make it as portable as possible. This is hard enough to do with application software written in a "high-level" language like Microsoft Basic, but the difficulties are compounded when writing system software since it is tied more closely to one particular machine. Further, efficiency (of both cpu and memory usage) are often more critical in system programs.

So, let's say you've cooked up a really super Pascal system written in assembly language for the Z-80, and now you want to move it to the Apple which has a 6502 processor. You could always recode the entire Pascal system for the 6502, but it would be almost as much work as starting from scratch. Or, you could write a Z-80 simulator for the 6502. This would be easier than rewriting all the Z-80 code, but the tradeoff is a loss of speed and a few K of memory because of the overhead of this added layer of interpretation. But what makes the Z-80 (or the 6800 or the Z-8000 or any other particular processor) especially great for writing a Pascal compiler and operating system? Well, nothing. As long as we're interpreting one machine on another, then, it makes sense to design a hypothetical processor which would be a nice home for running Pascal- with built-in instructions for doing Pascal-type things.

Guess what, computer fans, that's how UCSD Pascal works. Merely by implementing the infamous p-machine by interpreting it on an existing microprocessor, the entire Pascal compiler and operating system and utilities can be moved. So when you think the Apple is running Pascal, in fact, it is running a simulation of a computer which is running Pascal object programs.

Of course, if you want a real code crunching compiler that can squeeze every cycle and every spare byte out of the object code, then a compiler that makes executable native code for the host processor is in order. This approach is taken by Ithaca Intersystems pascal and Leor Zolman's BD C compiler, for instance. But neither of these compilers could be made to run on another microprocessor too quickly.

An alternative approach to make portable compilers (and other software) is to write everything, including the compiler itself, in a high-level language, let's say on machine A. Then, to move everything to machine B, we need only rewrite to code generator in the compiler on machine A so that it makes programs for machine B, run everything through the new compiler, and transport the resulting programs to machine B. Alas, writing good code generators is a tricky, art-not-a-science thing, and this approach has not been applied much to personal computers.

—SN

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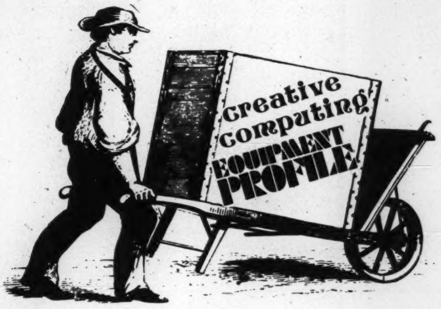

The TRS-80 Pocket Computer

Glenn Hart

I have seen the future, and I'm holding it in my hand! The new TRS-80 pocket computer ($249) is a breakthrough, the vanguard of a new generation of computing accessibility.

The TRS-80 PC appears at first glance to be either an unusually designed calculator or some sort of language translator. In fact, it is neither, being far more sophisticated than either. It is a complete *computer,* with keyboard, 24-character alphanumeric output display, Basic and monitor in ROM, 1.9K of non-volatile RAM, and an I/O port for storing programs and data on cassettes. Its capabilities would have been reasonably impressive in a first generation desk-top small computer(and are far in advance of the early *room-size* computers); in a package small enough to fit in a pocket they are astounding!

The Hardware

Measuring only 6⅞" x 2¾" x 19/32" and weighing a bit less than six ounces, the TRS-80 PC is sleek and attractive. The 57-key alphanumeric keyboard is laid out in a modified typewriter arrangement; the letter keys follow standard "QWERTY" practice while the numeric keys appear on the right side in calculator array. There are also several special purpose keys to handle editing and the generation of symbols, and 13 keys have alternate outputs selected by a SHIFT key. While the keys look rather small and close together and there is no tactile or audio feedback when a key has been depressed, keyboard action is very good and with only a little experience it becomes quite easy to enter text. It is even possible to "type" with both hands for quicker entry, although the nonstandard location of the numbers and the need to use the SHIFT key to enter simple punctuation takes a bit of getting used to. Eighteen keys are "reservable," meaning that special program segments can be preprogrammed into a dedicated memory area and called up quickly.

The liquid crystal display is highly legible in normal room light, but, like any other LCD display, it should be viewed more or less directly from above. A 5X7 dot matrix is used to generate upper case only letters and the various punctuation marks and special symbols. No graphics symbols are provided, but they would not be particularly appropriate on a one line display anyway. The input buffer is 80 characters, and if a line longer than the 24 characters displayed is entered the display uses horizontal scrolling in either direction. Cursor control is provided to move around the buffer area for editing and viewing long lines.

The input buffer is 80 characters, and if a line longer than 24 characters is entered the display uses horizontal scrolling in either direction.

A nine pin I/O connector on the left edge of the PC is used to connect the optional cassette interface ($49). Normally protected by a plastic cover, this connector could presumably be used to attach other peripherals even though Radio Shack has not announced the availability of anything other than the cassette interface. The cassette interface itself is a plastic cradle into which the PC is inserted. Various slots and protrusions on both the PC and the interface prevent incorrect attachment. Three cables are provided to connect the interface to the microphone, earphone and remote jacks of any cassette recorder. The new Radio Shack Minisette-8 is an excellent match in size and styling; together they form a complete system which fits in one corner of an attache case.

Radio Shack does not provide any information on the microprocessor or support circuitry other than to indicate that large-scale-integration CMOS devices are used. Rumor has it that TWO *four-bit* microprocessors are used: one to handle Basic instructions and one to perform calculations. At a time when some of the biggest excitement in microcomputing

HOW MANY SHARES?
DEG
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Radio Shack
TRS-80
CA/BREAK
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Glenn A. Hart, 51 Church Road, Monsey, NY 10952.

TRS-80, cont'd...

centers on the availability of sixteen bit CPU's (with 32-bit devices in the wings), the TRS-80 PC is graphic proof that important and interesting things can be done with many fewer bits on hand.

CMOS technology offers several advantages, the most significant of which is extremely low power consumption. The TRS-80 PC draws only *one-hundredth of a watt,* and can operate for up to three hundred hours on four small mercury batteries. The cassette interface requires three AA cells and the cassette recorder four.

Most importantly, the computer's memory is *non-volatile,* which means that it is not cleared when the power switch is turned off. Programs and data are retained in memory continuously and are immediately available for use when the computer is turned on. While this continuous memory has begun to appear on advanced pocket calculators, the TRS-80 PC is, to my knowledge, the first true personal computer (other than those with adapted core memory) with this convenient and useful feature.

The 1.9K of RAM available is divided into several segments. Basic program storage is limited to a maximum of 1424 "steps," with each step corresponding to a character in a program line. Note, however, that Basic commands are compressed to one byte tokens, so the *effective* program length is more than 1424 bytes. Twenty-six "fixed" memories are provided. Each can store the contents of one numeric or string variable, with the length of a string variable or constant limited to seven characters. If more variable store is required, up to 178 "flexible memories" can be allocated at the expense of program storage. In addition, there are 48 steps of "reserve memory." These hold up to 18 short program segments which can be retrieved easily for use in manual calculations of programming. The remainder of memory is allocated to the 80 character input buffer, an 8 step "data stack" and a 16 step "function stack." There is no apparent way to expand memory beyond that incorporated into the computer, but a surprising amount of useful programming can be done within the limited memory available.

The Basic Interpreter

The use of a high level language like Basic is what sets the TRS-80 PC apart from the many programmable calculators available today. As the owner of both a Texas instruments TI-59 and a Hewlett Packard HP-41C, I have enjoyed these devices and programmed them to perform many useful functions, but the pseudo assembly language necessary to program them is often a source of frustration at best and a total obstacle to certain tasks at worst. Radio Shack has asserted that the PC renders programmable calculators obsolete, and I would have to agree that machines that seemed advanced until now have suddenly become much less impressive.

The TRS-80 PC Basic interpreter is *not* a direct equivalent to any of the Microsoft-supplied interpreters used on full size Radio Shack computers. I am not particularly familiar with Level I or Level II Basic, but it seems that the PC interpreter has capabilities similar to those of Level I with a few bells and whistles added and some modifications made to handle the specific demands of a computer displaying only one line at a time.

Most of the Basic statements and commands have abbreviations which make entering programs quicker and more convenient.

TRS-80 PC Basic allows only 26 directly named variables, corresponding with the 26 "fixed" memory locations. Each location can contain *either* numeric or string information (strings are limited to seven characters) but not both. Thus variables A and A$ occupy the same memory, and only one or the other can exist at any time. Only one array, labeled A(), can be used; its elements point to the same memory locations as a direct reference would — at least up to A(26), which is the same thing as memory location Z. Up to 178 additional locations can be allocated to variable storage (at the expense of program storage). These locations can only be accessed as elements of the A array (e.g., A(145)).

The statements and commands provided are listed in Table I. LET works normally to assign values to variables and is, as usual, optional in most cases. (It is necessary only after an IF statement.) INPUT allows the entry of data from the keyboard, with prompting messages if desired. Prompts do *not* scroll horizontally, so it is necessary to limit the prompt message to what will fit on the display.

PRINT outputs messages and data to the display, as in most Basics. Due to the one line display, PRINT interrupts program execution until the ENTER key is depressed, similar to the interruption caused by an INPUT statement. The PAUSE statement performs the same functions as PRINT except that the information displayed appears for only a little less than a second (the display time could be a bit longer for maximum utility).

I was surprised to find that a limited form of PRINT USING is included (the USING formats can also be used with PAUSE). Only numeric formats can be specified. The normal "###.##"-type format sets the display mode; a carat sign sets scientific notation display. No provision is made for special formatting characters like dollar signs, asterisks, floating signs, etc. The format can be specified for all output with a USING statement by itself or the standard PRINT USING constructing can be used.

GOTO and GOSUB operate normally, except that alphabetic labels can be inserted in lines and GOTO and GOSUB can be instructed to branch to these labels as well as to simple line numbers. This is a nice feature rarely found in *any* Basic interpreters.

The IF statement does not require a following THEN (THEN is synonymous with GOTO), but therefore requires a LET if a variable assignment is to be made. FOR/NEXT loops operate normally, with a maximum nesting level of four. The STEP statement is available, but only with integer values.

BEEP sounds a small tone as many times as its parameter indicates. CLEAR clears all data memory. DEGREE/RADIAN/GRAD sets the mode for angular entries and calculations. AREAD reads a value into a variable prior to the start of execution of a defined program. REM allows comments to be inserted into

Statements					
LET	INPUT	PRINT	PAUSE	USING	GOTO
IF	THEN	GOSUB	RETURN	FOR	TO
STEP	NEXT	STOP	END	BEEP	CLEAR
DEGREE	RADIAN	GRAD	AREAD	REM	
Command Statements					
RUN	DEBUG	CONT	LIST	NEW	MEM
Cassette Tape Control Statements					
CSAVE	CLOAD	CLOAD?	CHAIN	PRINT#	INPUT#

Table I. TRS-80 Pocket Computer Basic Interpreter Statements and Commands

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TRS-80, cont'd...

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LN	LOG	EXP	SQRT	DMS	DEG
INT	ABS	SGN			

Table II. TRS-80 Pocket Computer Basic Interpreter Functions

a program (although heavy use of comments is unlikely with limited memory).

Commands usable only by manual entry include RUN to execute programs, CONT to continue interrupted programs, LIST to list program lines, NEW to clear memory, and MEM to display the remaining available program and flexible memories. The DEBUG command is similar to Microsoft's TRACE; the line number of each program line is displayed after it is executed.

The commands for cassette storage of programs and data follow closely normal Radio Shack Basic practice. The CSAVE and CLOAD commands perform the obvious functions, while CLOAD? verifies accurate saving or loading by comparing a cassette stored program with the contents of memory. PRINT# and INPUT# save data rather than programs. CHAIN loads new programs from tape and immediately executes them, either at the beginning of the new program or at a specified label within the program; this allows programs longer than memory to be segmented into smaller programs and executed sequentially, greatly increasing the power of the computer.

Table II lists the functions provided. A complete spectrum of trigonometric functions is available as well as several normal Basic functions. No string functions or logical operators are provided, although logical operations can be simulated with programming tricks explained in the user's manual.

Editing of program lines is possible with the cursor movement keys located in the lower right of the keyboard and the line movement keys above the center of the alphabetic area. The cursor can be moved to any spot in a line and the contents of that spot overwritten with new information. Alternatively, characters can be deleted or inserted at will. The line movement keys move the display within a program so any line can be accessed readily. As in other Basics, entire lines are deleted by typing their line number and ENTER and new lines can be added between existing line numbers. No renumbering facility is provided.

Operation and Evaluation

The TRS-80 PC operates in four modes, indicated by small status displays above the main 24 character display. The RUN mode is used both for manual calculations and to execute programs. If several programs are stored in memory at the same time and each is defined with an alphabetic label, the DEFINE mode is used to run the separate programs. PROGRAM mode is used for entry and correction of Basic programs. Most of the Basic statements and commands have abbreviations which make entry programs quicker and more convenient. RESERVE mode is used to enter short programs and/or statements into the 48 step reserve memory. Two small templates are provided which fit over the reservable keys; these can be used to indicate what program or statement has been assigned to the individual key.

Radio Shack does not supply any information on clock speed. In general, Basic programs execute rather slowly, although they seem to run at least as fast as equivalent programs coded for my programmable calculators. The TRS-80 PC maintains up to 23 digit precision internally (although displayed results are limited to 10 digits before the computer switches to scientific notation), so some premium in execution speed is certainly justified by this very high precision.

The looks on their faces when I demonstrated the TRS-80 PC more than justified its purchase price.

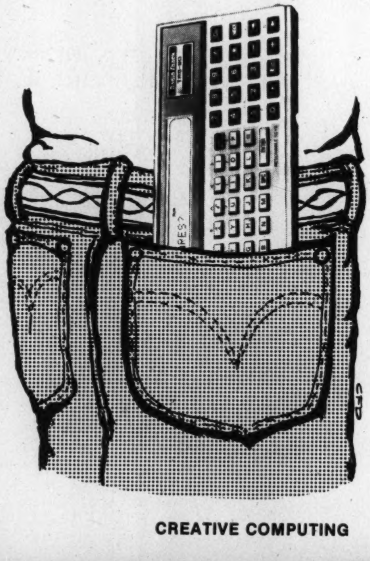
In practical use, the TRS-80 Pocket Computer is a delight. Manual calculations are a pleasure, since so much of the input is retained on the display and can be corrected if necessary. A user who constantly requires trig functions might find a calculator faster than having to type in the function names, since the necessary function keys are immediately available.

Programming is vastly improved over programmable calculators. Any reasonably competent Basic programmer can put the PC through its paces and generate complex programs *much* faster. The interpreter is surprisingly capable and easy to program; the debugging and editing functions make program correction simple. The full alphanumeric 24 character display is a pleasure (the alpha display of the HP-41C seemed advanced only a few months ago; now it is impossibly restricting).

I have already used the PC in several business meetings where I was able to use pre-stored programs to good advantage and even write and execute new programs on the spot to answer complex business problems. Its small size has earned it a permanent spot in my attache case; I am not willing to be without it wherever I travel.

This is not to say that the machine is perfect. Several other manufacturers have announced similar products which would appear to have more capabilities, either more memory or available printers, modems, etc. I am sure that the TRS-80 PC will be surpassed in the future unless Radio Shack makes a major commitment to expanding this end of their business. The presence of that I/O connector would indicate that such expansion is possible. None of the software packages designed for the PC were available at the time this review was written; a large software library will be necessary to wean many prospective purchasers off their programmable calculators and their large software base and user groups. I guess that we computerists are by nature greedy gluttons; we get a wonderful feast of new technology and all we want is more!

In the meantime, the TRS-80 Pocket Computer is the state-of-the-art. It is not denigrating the usefulness of this computer to also point out that it is a terrific toy and an absolute conversation stopper. The day after I bought mine I had two mainframe-computer specialists, each controlling several million dollars of hardware, in my office to discuss development of a complete business control system. The looks on their faces when I demonstrated the TRS-80 PC more than justified its purchase price. Their chagrin when I pointed out to them that it was the lizards who survived, not the dinosaurs, made my day! ☐



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The Apple II and Apple II Plus

David Lubar

Making the plunge for a personal computer is a big decision, involving a fair amount of money. If you're in the market, the Apple is a good choice, with a lot of positive aspects, and a few bad points, much of which will be covered here. People buy computers for a variety of reasons; some just want to play games, some want to develop programs, and some need specific applications such as word processing. I'll address the game players first. The Apple has all the requirements in this area; high-resolution color graphics, paddle or joystick control, and a large amount of available software. Let's take a closer look at these areas. The graphics, with six colors, are good enough to produce games that are close to arcade quality. The low resolution mode, with sixteen colors, also is the basis for a number of good games.

In the paddle capabilities, a distinction must be made between potential and actual use. The Apple can handle four paddles and three buttons. But, since the system comes with two paddles and two buttons, most software is written for this configuration. A manufacturer would be taking a chance selling a game that couldn't be used by the majority of Apple owners. Some dual-joystick packages are beginning to appear, with hardware and software. If this catches on, we'll see some nice software in the near future. (A joystick is the equivalent of two paddles, and is easier to use in games where one player is controlling two factors, such as horizontal and vertical movement.) In the past, the paddles that came with the Apple were rather poor in quality. The new Apples have different paddles, but it is hard to tell whether they are better internally.

The availability of software from a number of sources is important. There are hundreds of games for the Apple; arcade games, chess and bridge games, adventures. The Apple comes with enough software to keep you up till sunrise for a few weeks. The Integer version has *Startrek* and *Starwars*, the Applesoft version also has some nice games, including *Penny Arcade*.

The instruction manuals, covering everything from setting up the computer and loading tapes to programming and debugging are well done, extensive, and easy to follow. Even if you get an Apple just to play games, you'll probably end up doing some programming, which brings us to the next aspect of the Apple. There are two versions of Basic available; Integer and Applesoft. Integer Basic is fast, easy to use, and gives immediate error messages. But it has some limitations. It only handles integers in a range from -32767 to 32767, and allows integer arrays of only one dimension, with no string arrays. This might not be an important issue since Integer seems to be phasing out, with most new programs being written in Applesoft or machine language. And, since either Apple can, with the addition of a special card, handle both Basics, a purchase of either Apple doesn't restrict future use.

Applesoft is a version of Microsoft Basic, with extended functions for graphics. Both Applesoft and Integer Basic give understandable error messages. A mistake will produce something such as, "Memory full" as opposed to a cryptic "Error 23." The Apple can also be programmed in 6502 assembly language. The Integer version has a mini assembler. The Plus doesn't, but there are a number of good assemblers available. I won't go into any debate over the good and bad points of the 6502, but will mention that anyone who learns to use it will be able to "talk to" a number of popular computers, including the PET, Atari, and OSI.

Apple's great documentation means that programmers will have an easy time making use of all the features of the machine. Whatever Apple hasn't had a chance to tell has been covered by the many fine user's groups. Apple owners are an active bunch, and most areas of the country have at least one Apple club.

Another important consideration is expansion. While the Apple might be a bit more expensive at the start, it is designed for expansion and will cost less in the long run. Disk drives can be attached to a card that plugs right into the Apple; no extra power supply is needed. Memory is also plugged right in; no interface is needed. As with software, there are also a lot of hardware companies making products for the Apple. Everything from music boards and speech boards to graphics pads and light pens can be found. Apple seems to encourage this, knowing that it helps make the computer better and more versatile.

My only criticism in this area is that Apple charges too much for extra memory. This seems to be the case with all the computer manufacturers. Luckily, many stores that carry the Apple also carry memory kits at a reasonable price.

The Apple doesn't come with lower case; a bit of a problem for those who want to do word processing. But lower-case modifications are available, and there are several companies selling good software for word processing on the Apple.

What else? The company is fairly responsive to user questions, but somewhat inconsistent. Some queries are answered quickly, others are ignored. Still, in general, Apple seems to be concerned about the user. The Apple produces some radio-frequency interference (RFI) which might interfere with near-by television sets, but the company is working on the problem and has found some ways to reduce the RFI.

The dependability of the Apple should also be mentioned. Hardware problems are very rare. The chance that any repairs will be needed is small. And most repairs can be handled by a dealer since Apple trains all authorized dealers.

To sum things up, the Apple has a lot going for it. New software and hardware will continue to appear. I highly recommend this computer. ☐

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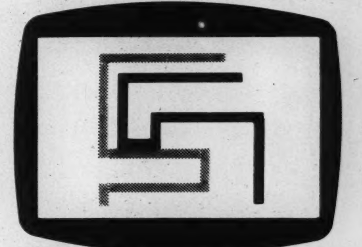
Strategy Games

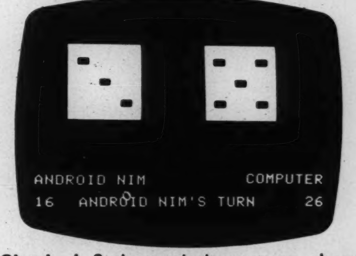
Cassette CS-4003 $11.95 4 Programs Requires 16K Apple II or Apple II Plus



Blockade. Build a wall to trap your opponent, but don't hit anything.

```
SHIP APPROACHING AT 6767 182 KM
```

UFO. Use lasers, warheads or guns to destroy an enemy spacecraft.



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ANDROID NIM                COMPUTER
16   ANDROID NIM'S TURN          26
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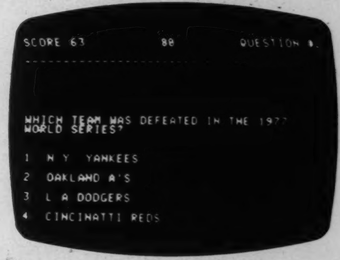
Skunk. A 2-player strategy game played with dice, skill and luck.



```
SCORE 63          80          QUESTION 8.
-----------------------------------------

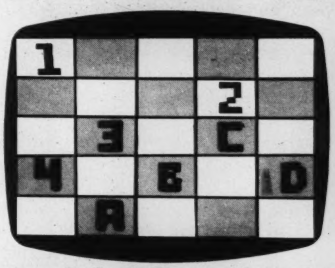
WHICH TEAM WAS DEFEATED IN THE 1977
WORLD SERIES?

1  N Y  YANKEES
2  OAKLAND A'S
3  L A DODGERS
4  CINCINATTI REDS
```

Genius. A fast-moving trivia quiz with scores of questions.

Brain Games

Cassette CS-4004 $11.95 7 programs Requires 16K Apple II or Apple II Plus



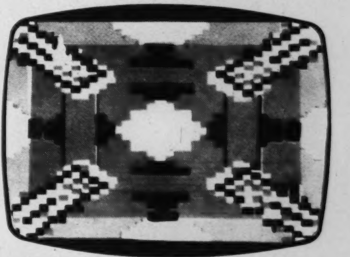
Dodgem. Be the first to move all your pieces across the board in this intriguing strategy game.

123456
1
2
3
4
5
6

```
GREEN'S MOVE (HOP VERT)          TIME=14
```

Nuclear Reaction. A game of skill, fast decisions and quick reversals of position.

Parrot. A Simon-type game with letters and tones. **Dueling digits** is a version with numbers.



Midpoints and Lines. Two colorful graphics demonstrations. **Tones** lets you make music and sound effects.

Strategy and Brain Games are also available on one 32K Apple disk (CS-4502) for $24.95. Add $2.00 shipping per order. Send to **Creative Computing Software**, P.O. Box 789-M, Morristown, NJ 07960. Or call 800-631-8112.

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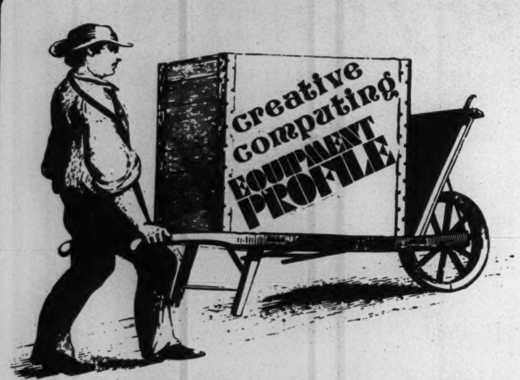

The Atari

Bob Callan

Merry Christmas to those who find an Atari under their Christmas tree this year. There are many discoveries awaiting you which might not appear in ads, or may not be discussed by salespeople.

The Atari has excellent RF (Radio Frequency) shielding. This is evident in the lack of Radio Frequency Interference (RFI) on the color TV that you hook up to the Atari. The low RFI permits distortion-free characters and crisp, undiluted colors. Your neighbors will also enjoy your Atari, as they can watch their TV without seeing weird patterns of RFI caused by your computer. The Atari was one of the first small computers with adequate RF shielding. Although all new home computers are required to have this shielding, there are still many unshielded ones in stockrooms.

The RF shielding surrounds the cartridge cavities, located under the cover, behind the keyboard. If you lift off the cover you will see the heavy-looking metal shielding that is molded into the pits that contain the RAM, ROM, and game cartridges. The cartridges fit snugly into these spaces, leaving little room for air to circulate.

The snug fit and metal enclosure combine to create problems on warm days, or after many hours of operation. The electrical resistance of the parts in the RAM cartridges generates heat. The metal shielding acts like a heat sink. The air vents in the cover of the Atari don't provide sufficient ventilation to keep the Atari functioning properly after many hours of operation. When this happens, error messages appear frequently, without the errors occuring. Debugging becomes impossible.

Don't be overly concerned. First, heat can cause small computers, as well as the big ones, to malfunction. Unless you use your Atari for eight hours, or on hot days without air conditioning, you probably won't encounter any difficulties. Second, you can cool it. Remove the RAM, ROM, and Operating System cartridges and place them in a cool, dry stream of air. In five minutes the cartridges and the metal shielding should be cool enough to give you several more hours of trouble-free operation.

There are other discoveries to be made concerning the Atari. The *Star Raiders* game and *Basketball* are only two of the many cartridges available as part of the entertainment aspect of the Atari. On the educational side, the cartridges range from Sociology to Physics.

The Atari presents a challenge to both the beginning and the more experienced programmer. For the beginning programmer, the *Atari Basic: A Self-Teaching Guide* is a good self-paced instruction manual for Atari Basic. For the more experienced programmer, the *IRIDIS* vol 1 and 2 provide valuable information on such varied programming aids as; partial memory map, screen display lists, and real time programming. These books are valuable to programmers, especially when converting programs from the Apple to the Atari. The manual that comes with the Atari is essentially a reference manual describing the commands and some of the operations. The programs listed in this manual are very explicit and are documented, but the manual isn't particularly helpful when you are trying to animate a shape or display letters on the screen in a graphics mode. Atari's Assembler cartridge and documentation will make this type of programming less difficult.

Programming the Atari is wonderful in several ways. When you type in a command improperly, an error message appears. What could be more friendly? It even prints the erroneous character in inverse video. You can see where you made a mistake. This doesn't replace debugging, but it certainly helps. The Atari has full variable names like SHOT, AMMO, GEESE, and COUNTER. Following the flow of a program is much easier with these variables. If you want to type in inverse video, to signal a REM, the beginning or end of a subroutine, or to print on the screen, you have to press just one key. Lower case letters are procured by pressing the cap and shift key.

Perhaps the most functional part of the keyboard is the Editor. Using the control key and six or so other keys, the cursor can be easily moved anywhere on the screen. Program lines or characters can be quickly and easily replaced, inserted or deleted.

There is another feature that is particularly useful to teachers. You can get two video outputs from the Atari without using RF boosters. One output is an RCA-type which connects to a regular RF unit attached to a TV. The other output can be attached to a monitor, or to a video-recorder. Using this arrangement, you can watch the video display, what is happening in the back row, and what you are inputting into the computer. This is easier than turning around constantly. If turning around doesn't bother you, there are now two video displays, which means everyone

some interesting lessons using computer-video integration may be possible.

The Atari's color and sound, and the accessibility of these to even an inexperienced programmer, make the Atari a good choice for involving students, even young ones, in computer programming. Although there is not a large amount of software available at the K-8 and high school level, more software is being developed. It is important for teachers to make their software needs known, and to let software developers know there is a market for educational software. Wouldn't textbooks be different if classroom teachers gave more input? As an instructional aide, television has not met its potential. This is the stage of development of software where teachers can help computers reach their full potential as educational aides.

The Atari is entertaining, and educational. As a fourth generation computer, Atari has many of the good features of earlier computers plus some innovative ideas. The addition of several new peripherals to the line deletes a commonly-cited objection to buying an Atari. Although the Atari Basic incorporates easy use of graphics and sound, the next big improvement would be a version of Microsoft Basic. Maybe Santa will bring it for Christmas. □

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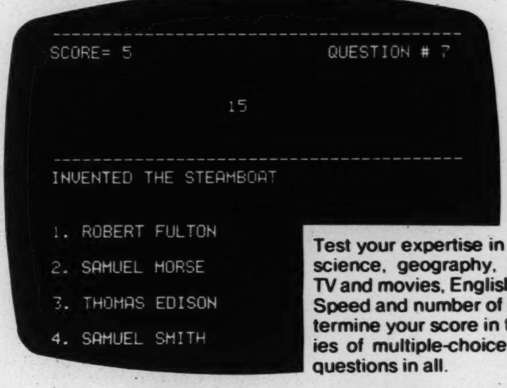

```
SCORE= 5                    QUESTION # 7

                    15

INVENTED THE STEAMBOAT

1. ROBERT FULTON

2. SAMUEL MORSE

3. THOMAS EDISON

4. SAMUEL SMITH
```

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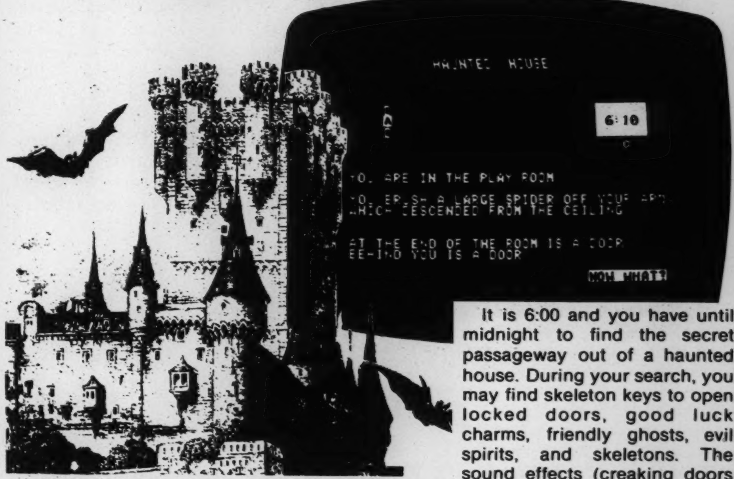

```
HAUNTED HOUSE

                                  6:10

YOU ARE IN THE PLAY ROOM

YOU BRUSH A LARGE SPIDER OFF YOUR ARM
WHICH DESCENDED FROM THE CEILING

AT THE END OF THE ROOM IS A DOOR
BEHIND YOU IS A DOOR

                               NOW WHAT?
```

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Creative Computing
EQUIPMENT PROFILE

Why I Like the TRS-80

Stephen B. Gray

It's become fashionable in many personal-computer circles to call Radio Shack's machine the "Trash-80," to speak of Model I's hardware as poorly designed, and to cite various inadequacies of Level II Basic.

Yet, despite all these hardware and software problems, Radio Shack has somehow managed to sell over 200,000 (perhaps 250,000 by the time you read this) of these "poorly designed and inadequate" computers.

How did Radio Shack manage to fool so many people? How were a quarter of a million people hoodwinked into buying such an inferior piece of merchandise?

What They Wanted

One answer is that Radio Shack provided what many people out there wanted, at a price they felt was right, and at thousands of outlets all over the country where a person could go try it out before buying.

Once the TRS-80 caught on, the name became as magic in its own field as IBM's in the mainframe business. IBM may not make the best computers, or the fastest ones, but it knows, better than all the rest, the importance of service and support.

Radio Shack made a lot of mistakes with the TRS-80, as would any company marketing the first popular ready-to-run personal computers. But they've learned a lot, they've made tens of thousands of free fixes, and they've brought out three more TRS-80 computers that alone may well outsell both Apple and PET.

My TRS-80

Nobody who's used a personal computer for more than a few weeks is completely satisfied with it. There are always some features on other machines he'd like to have on his.

I've had a 16K Level II Model I since December 1977. I've been writing the TRS-80 column in this magazine since the Nov-Dec 1978 issue.

It took me months before I realized that some of my dissatisfaction with my TRS-80 was due to my not completely understanding how it works, and exactly how to program some difficult tasks.

Once I began to realize what my TRS-80 could do, and could not do, I began to appreciate it much more.

There's a great deal I still don't know about the TRS-80. I'm not all that much into machine language, preferring to use Basic, (which I'm still learning about,) in areas such as strings, matrices, and TRS-80 graphics.

USER'S MANUAL FOR LEVEL 1
Radio Shack
TRS-80
MICRO COMPUTER SYSTEM

But the more I use the Level II computer, the more I like it. I know just about what it can do, and can't, and I recommend it to most of the people who ask me what personal computer to buy.

Most, but not all. The TRS-80 can't please everybody, which is why the Apple II, PET, Atari and Sorcerer computers sell as well as they do.

What I Like About the TRS-80

Service and support are two of the main reasons for my liking the Level II TRS-80.

As for service, when I had problems with my RAM memory, and also wanted the lower-case modification installed, along with the free cassette-loading fix, all I had to do was take my keyboard unit down to a Computer Center in lower Manhattan, where a skilled technician took all of 55 minutes to fix the memory problem (a faulty RAM IC) and install the two mods.

Who else has over 85 Computer Centers around the country? How many other personal-computer manufacturers require that you *mail* the computer to them for service?

As for support, I'm talking about the vast amount of absolutely fascinating Level II software available.

I don't mean Radio Shack's programs, most of which have shown a great deal of conservativism and lack of imagination. (Although they're beginning to break away from the mold, and have brought out some good programs lately, mostly written by outsiders, and including Scripsit, Astrology and Dancing Demon.)

Although a great many poor programs are being sold by people whose main interest seems to be in making a fast dollar, some very clever software is being written by programming geniuses. Leo Christopherson, who wrote Dancing Demon, has written several outstanding games. Lance Micklus is another master gamesman.

The pages of *Creative Computing* and other computer magazines are full of ads for some highly imaginative TRS-80 games and some very well thought out utility and business programs for the TRS-

80. There are programs for fighting your way through a dungeon full of demons, playing music, drilling children in math, balancing a checkbook, communicating on a network, performing advanced math, writing paychecks, word processing, playing baseball, simulating lab experiments, playing the horses, turning on household appliances, creating and using a database, printing a mailing list, controlling inventory, working in double-precision math, managing a budget, tracking stock trends, generating a horoscope, drawing animated movies, playing chess and backgammon, and hundreds more.

Yes, the other popular personal computers have a lot of programs, but nowhere near the variety and number written for the Level II TRS-80.

More publications specialize in the TRS-80 than in all the others put together: *80-US, The Eighty, 80 Microcomputing, PROG/80, S-80 Bulletin, Insiders,* and probably a couple more I don't know about. That's in addition to the magazines that regularly run TRS-80 articles.

What I Don't Like About the TRS-80

There are some things I don't like about the TRS-80, although several of these have been taken care of with free modifications.

I got terribly annoyed when extra letters started showing up on my screen, as in NEXXT, FFOR and RNND. That can be fixed by prying up the keys and cleaning the spring contacts; the newer keyboards don't use spring contacts.

The lack of lower-case letters was a nuisance until I had the lower-case mod installed. There were problems loading some tapes, until I had the free cassette-loading mod installed, which enabled me to load all but the very worst tapes.

The Level II TRS-80 Model I doesn't have color. But now there's the TRS-80 Color Computer. Several things were left out of Level II Basic. But they are in Microsoft's Level III Basic.

The Level II manual is really a reference manual, and as such is missing a great deal of helpful information. But Radio Shack promises to publish its own Level II user's manual some day. And several fine Level II manuals have been written outside Radio Shack.

Using cassettes for storing programs used to require a lot of cable-plugging and unplugging. But then I discovered a switchbox (Dick Fuller's RF-II) that eliminates all the cable-handling, also provides a speaker for listening to the bitstream, and permits easy copying of tapes from one cassette recorder to another.

The TRS-80 Model I has no software-definable keys like the Exidy Sorcerer. But the TSHORT program from Web Associates provides that capability, in addition to several others.

The TRS-80 Voice Synthesizer is difficult to understand. But for another $300 you can get a much more easily understood voice synthesizer elsewhere. And I wouldn't be surprised if Radio Shack brings out a better voice synthesizer next year. (No, I haven't heard any rumors to that effect.)

A good letter-quality printer costs about $2,000. Well, that's really a problem, and my only solution is to save up for one.

Conclusions

After three years of using a TRS-80, I've learned its many capabilities and few weaknesses, and have learned to live with them. Occasionally there are some problems, such as when the Scripsit word-processing program doesn't work the way I want it to, but that's mostly because I don't use it enough to be fluent in all its idiosyncracies.

I wouldn't trade my Level II TRS-80 for any other personal computer made, except for Radio Shack's Model III, with integral disk drives and keyboard.

If there's a peripheral or program I want that doesn't exist, and it's not too far out, somebody will be selling it before long. □

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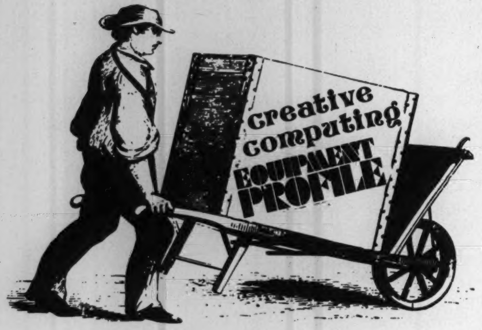


The PET

Frank Covitz

This article describes the pros and cons of the Commodore PET 2001 series personal computer. It is written from the point of view of someone (me) who has used a PET since it was first introduced, and has had some (admittedly limited) experience with other personal computers.

No single machine has everything, so the crux of the matter is to gain an appreciation of how the hardware, firmware, and software interact to your benefit, and to what extent they limit you. These three topics are not strictly separable, but I will use this categorization to keep me from wandering in the following discussion.

HARDWARE

The PET has everything required to operate in a single attractive package — except the cassette recorder. The original PET had a built-in recorder, but a small keyboard. (Although the small keyboard version is no longer being produced, you may be able to get an excellent buy on a used and therefore thoroughly "burned in" small-keyboard model.) The advantage (or disadvantage) of having everything built-in is very much like the corresponding situation with audio equipment, i.e., receiver vs. separate components. For me, it is an advantage since I don't want to contend at the start with a mess of connecting cables (I tend to weave my own tangled web, so who needs additional wires), and I don't have to tie up a TV set for the display. It does, however, mean that the PET is not easily portable.

The black-and-white video image is crisp and stable, and the background is truly black. The display is memory-mapped (more about that later) into 25 lines of 40 characters. Each character is formed via a character generator ROM within an 8*8 pixel cell (the total screen resolution is therefore 320 horizontal by 200 vertical). In addition to the standard alpha-numerics, you also get a set of graphic symbols, some of which are obviously game-oriented (the card suit symbols, for example). These permit pictorial and graphic images to be formed under program control. I am constantly amazed at the degree of cleverness with which people have put these graphic symbols to use within their programs. A lower-case character set (with descenders) is software selectable, with an attendant loss of most of the graphic symbols.

The (full-sized) keyboard is of good but not superb quality, and the numeric and cursor control keypad are in a conveniently separate cluster. Graphic symbols are visible on the forward vertical side of the keycaps and are accessed in conjunction with the SHIFT key. All alpha-numeric and graphic symbols may be displayed in normal or reverse-field mode at the keyboard or under program control. A single RUN/STOP key permits you to load in whatever program is next on tape with a single key-stroke, although in general named programs will probably be used within the format of a LOAD command. (A PET operating system, called Basic 4.0, is available which default loads from the disc rather than tape.) The STOP function of this key is somewhat misleading. It is normally effective when the program is running under the control of the Basic operating system, and will get you cleanly out of loops and allow you to abort your programs early. It is essentially useless, however, if you intend to do machine language programming. Under "crash" conditions, you are normally forced to do a power-on reset, which obviously wipes out your program. There is, however, a user-supplied hardware solution, using the RESET and DIAGNOSTIC SENSE wires. It is relatively simple to wire in, but should not be attempted unless you have some hardware abilities, and are willing to invalidate the warranty. On the positive side, the STOP key can be de-activated under program control, which technique can be used to prevent "curious fingers" from stopping your program.

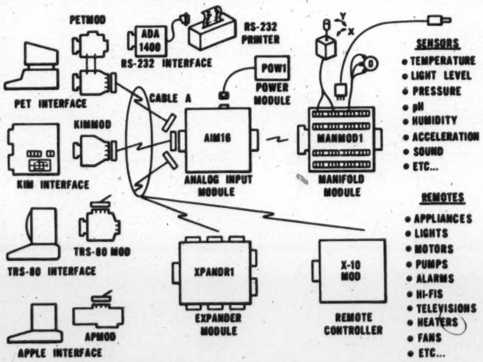
Next in the hardware discussion is the cassette tape storage and retrieval function. Programs and data can be stored and retrieved on cassette tape at the moderate speed of about 80 characters per second. My experience has been good in the sense that I have been able to read in 95+% of PET tapes written by other PET's and have never received complaints when I've sent out tapes.

Actually, two separate tape drives are supported, so that aside from the slow speed and inherently sequential nature of data on tape, it is at least possible to do data-base programming. The tape motor (but not the PLAY and RECORD buttons) is under system control, so the tape will stop when the end of a program or data file is reached. The COMMODORE tape units do not have audio output, so you will not get an audio feedback (which can be quite comforting at times) to let you know all is well, nor do they have tape counters. Thus, it is pretty inconvenient to store several programs or data sets on the same cassette. However, there is nothing magic about the cassette hardware, so that conventional cassette recorders can be adapted to work on the PET, again with some hardware experience.

Next on the hardware agenda is the IEEE-488 bus. This capability permits the PET to service multiple peripheral devices, such as printers, disk drives, plotters, etc.

Frank Covitz, Deerhill Rd., Lebanon, NJ 08833.

MICROCOMPUTER MEASUREMENT and CONTROL for PET, Apple, KIM, and AIM



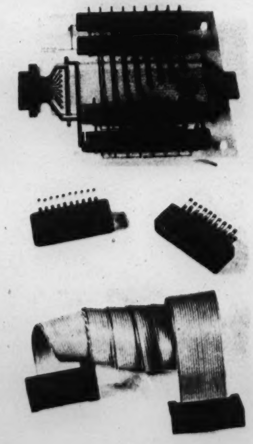
The world we live in is full of variables we want to measure. These include weight, temperature, pressure, humidity, speed and fluid level. These variables are continuous and their values may be represented by a voltage. This voltage is the analog of the physical variable. A device which converts a physical, mechanical or chemical quantity to a voltage is called a sensor.

Computers do not understand voltages: They understand bits. Bits are digital signals. A device which converts voltages to bits is an analog-to-digital converter.

Our AIM 16 (Analog Input Module) is a 16 input analog-to-digital converter.

The goal of Connecticut microComputer in designing the uMAC SYSTEMS is to produce easy to use, low cost data acquisition and control modules for small computers. These acquisition and control modules will include digital input sensing (e.g. switches), analog input sensing (e.g. temperature, humidity), digital output control (e.g. lamps, motors, alarms), and analog output control (e.g. X-Y plotters, or oscilloscopes).

Connectors



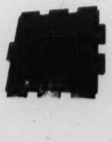
The AIM 16 requires connections to its input port (analog inputs) and its output port (computer interface). The ICON (Input CONnector) is a 20 pin, solder eyelet, edge connector for connecting inputs to each of the AIM16's 16 channels. The OCON (Output CONnector) is a 20 pin, solder eyelet edge connector for connecting the computer's input and output ports to the AIM16.

The MANMOD1 (MANifold MODule) replaces the ICON. It has screw terminals and barrier strips for all 16 inputs for connecting pots, joysticks, voltage sources, etc.

CABLE A24 (24 inch interconnect cable) has an interface connector on one end and an OCON equivalent on the other. This cable provides connections between the uMACSYSTEMS computer interfaces and the AIM 16 or XPANDR1 and between the XPANDR1 and up to eight AIM 16s.

XPANDR1

The XPANDR1 allows up to eight Input/Output modules to be connected to a computer at one time. The XPANDR1 is connected to the computer in place of the AIM16. Up to eight AIM16 modules are then connected to each of the eight ports provided using a CABLE A24 for each module. Power for the XPANDR1 is derived from the AIM16 connected to the first port.



Analog Input Module

The AIM 16 is a 16 channel analog to digital converter designed to work with most microcomputers. The AIM16 is connected to the host computer through the computer's 8 bit input port and 8 bit output port, or through one of the uMAC SYSTEMS special interfaces.

The input voltage range is 0 to 5.12 volts. The input voltage is converted to a count between 0 and 255 (00 and FF hex). Resolution is 20 millivolts per count. Accuracy is 0.5% ± 1 bit. Conversion time is less than 100 microseconds per channel. All 16 channels can be scanned in less than 1.5 milliseconds.

Power requirements are 12 volts DC at 60 ma.

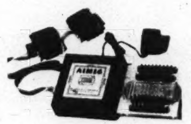
The POW1 is the power module for the AIM16. One POW1 supplies enough power for one AIM16, one MANMOD1, sixteen sensors, one XPANDR1 and one computer interface. The POW1 comes in an American version (POW1a) for 110 VAC and in a European version (POW1e) for 230 VAC.

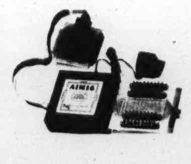
TEMPSENS

This module provides two temperature probes for use by the AIM16. This module should be used with the MANMOD1 for ease of hookup. The MANMOD1 will support up to 16 probes (eight TEMPSENS modules).

Resolution for each probe is 1°F.

Computer Interfaces and Sets





For your convenience the AIM16 comes as part of a number of sets. The minimum configuration for a usable system is the AIM16, one POW1, one ICON and one OCON. The AIM16 Starter Set 2 includes a MANMOD1 in place of the ICON. Both of these sets require that you have a hardware knowledge of your computer and of computer interfacing.

For simple plug compatible systems we also offer computer interfaces and sets for several home computers.

AIM16 (16 channel-8 bit Analog Input Module)	**179.00**
POW1a (POWer module-110 VAC)	**14.95**
POW1e (POWer module-230 VAC)	**24.95**
ICON (Input CONnector)	**9.95**
OCON (Output CONnector)	**9.95**
MANMOD1 (MANifold MODule)	**59.95**
CABLE A24 (24 inch interconnect cable)	**19.95**
XPANDR1 (allows up to 8 Input or Output modules to be connected to a computer at one time)	**59.95**
TEMPSENS2P1 (two temperature probes, -10°F to 160°F)	**49.95**
LIGHTSENS1P1 (light level probe)	**59.95**

The following sets include one AIM16, one POW1, one OCON and one ICON.

AIM16 Starter Set 1a (110 VAC)	**189.00**
AIM16 Starter Set 1e (230 VAC)	**199.00**

The following sets include one AIM16, one POW1, one OCON and one MANMOD1.

AIM16 Starter Set 2a (110 VAC)	**239.00**
AIM16 Starter Set 2e (230 VAC)	**249.00**

The following modules plug into their respective computers and, when used with a CABLE A24, eliminate the need for custom wiring of the computer interface.

PETMOD (Commodore PET)	**49.95**
KIMMOD (KIM, SYM, AIM65)	**39.95**
APMOD (APPLE II)	**59.95**
TRS-80 MOD (Radio Shack TRS-80)	**59.95**

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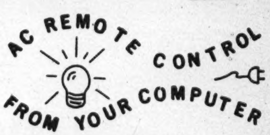

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   Day of the week.
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   8 inputs - TTL levels or switch closures.
   Can be used as triggers for stored sequences.
   8 outputs - TTL levels
4. Computer interfaces
   S-100: Requires one 8-bit input port and one 8-bit output port.
   Requires cable assembly.
   PET, APPLE, TRS-80, KIM, SYM, AIM65: Plug-in sets available - no cable assembly required.
   Other: same as S-100
5. Self-contained module in metal case with its own power supply. Physical size approximately 5X6X2.

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The following sets include one AIM16, one POW1, one MANMOD1, one CABLE A24 and one computer interface module

PETSET1a (Commodore PET - 110 VAC)	**295.00**
PETSET1e (Commodore PET - 230 VAC)	**305.00**
KIMSET1a (KIM, SYM, AIM65 - 110 VAC)	**285.00**
KIMSET1e (KIM, SYM, AIM65 - 230 VAC)	**295.00**
APSET1a (APPLE II - 110 VAC)	**295.00**
APSET1e (APPLE II - 230 VAC)	**305.00**
TRS-80 SET1a (Radio Shack TRS-80 - 110 VAC)	**295.00**
TRS-80 SET1e (Radio Shack TRS-80 - 230 VAC)	**305.00**

QUANTITY	DESCRIPTION	PRICE	TOTAL
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PET, cont'd...

As many as 26 external devices can be physically connected in "daisy-chain" style to the PET's IEEE-488 bus, although a maximum of 10 can be active at the same time. The beauty of this way of handling peripheral devices is that there is no programming overhead in operating these devices, i.e., communication to the printer, disk drive, etc. is handled with the same programming techniques. Commands as well as data can be transmitted, so that the external device can have its own "smarts." For example, you can command the disk peripheral to make a disk-to-disk copy with a single command; as soon as the command is sent, the disk system goes on its merry way to complete this several minute task, but the PET is free for any non-disk related task. IEEE-488 devices presently available from Commodore are line printer, dual floppy-disk, telephone modem, and recently, a speech synthesizer. Other IEEE-488 devices are available from a wide variety of manufacturers, but I would definitely advise the reader to specifically verify that they will work with the PET by contacting the manufacturer. On the negative side, IEEE-488 compatible devices tend to be somewhat more expensive than RS-232 devices.

The PET has an 8 bit USER PORT, and two "handshake" lines that are uncommitted, and therefore are completely under control of the user. The physical wires are accessible on an edge connector at the rear of the PET. Software control out of Basic is accomplished by PEEK'ing and POKE'ing to specific address locations. Utilization of the user port requires hardware experience. The lines can in general drive one TTL load, and would therefore need buffering to be used, for example, to turn on a power relay. I have personally used the user port in several ways, for example, to drive a digital-to-analog (DAC) converter to produce music, to communicate data at high speed (about 40,000 bytes per second) between the PET and a KIM or AIM, and to input high speed analog-to-digital data. One of the most common uses of the single bit "CB2" control line is to generate sound effects when connected to an audio amplifier and speaker. Not particularly well known is the fact that the user port has access to a fairly sophisticated timer (part of the 6522 integrated circuit which supplies the user port function) which again is under user control.

The final hardware item to be discussed is the EXPANSION BUS. These wires are accessible at the right side of the PET and communicate at nearly the lowest possible level to the 6502 microprocessor chip that runs the whole show. Available are buffered address lines 0-11, 4K selects for blocks 0-7 and 9-B,, the buffered data bus, the R/W, IRQ, RESET, and CLOCK signals. The expansion bus is not easily used, since it required detailed hardware and software expertise on a machine language level. However, it can be used for memory expansion in both ROM, RAM, and I/O. Several manufacturers make memory expansion boards that connect to the expansion bus.

32K
commodore
PET
professional
computer

FIRMWARE

Turn on the power switch of the PET, and you are in the Basic operating system. One of the most important features of the PET firmware is its advanced screen editor. What this means is that as long as your command or program text is visible on the screen, it can be edited with minimum effort. Cursor control keys take the blinking cursor anywhere on the screen, at which point you can overwrite, delete, or insert characters, without having to type in anything additional except RETURN. For example, if you are keying in Basic program lines and discover that you misspelled something 5 lines back, you just position the cursor over the offending area and correct only the error (remember to hit RETURN). Once you get used to this feature, you will look at any operating system that doesn't have this powerful editing feature as "primitive."

Another powerful feature of the operating system firmware is the real-time clock, updated every 1/60 second. Two special variables, TI and TI$, are available to the user for use directly or within programs. This interrupt driven feature also scans the keyboard, and permits look-ahead key entry. This feature means that your keystrokes are remembered, even when the system is nominally "busy." Again, you will only appreciate this on comparison with systems which don't have this feature. On the negative side, the interrupt driver can get in your way in certain machine language programming techniques.

Almost all the commands available to Basic are usable in the direct mode (no line number). This means, for example, you can evaluate arithmetic expressions directly, without writing a separate program. Overall, PET Basic compares favorably in both flexibility and speed with most other Basic's I've seen on other personal computers. PET Basic has a fairly advanced instruction set, including some very powerful string handling functions, and an easy to use IEEE-488 command set. Variables can be integer, real, or string type, and all of them can be multiply subscripted. It also has PEEK and POKE, which allows you to interrogate and alter memory directly. The SYS and USR commands allow you to access machine language routines, but the beginner should be aware that there are many pitfalls (potential crashes) involved.

The final firmware feature that the potential PET user should be aware of is the machine language monitor (MLM). In the early version of the PET, this needed to be loaded from tape. In current versions (Basic 2.0 and 4.0) the MLM is in ROM. The contents of sequential memory locations can be displayed via the command M XXXX-YYYY (XXXX is the start addresses and YYYY is the end address). The nice feature here is the ability to use normal cursor editing to modify either memory locations or register contents. The other commands available via the MLM allow you to execute machine code at a specified address, load and save programs or data on either tape or via an IEEE-488 device, and finally, to return to Basic. The beginner may be reluctant to enter the machine language realm (but why not give it a try? — the command structure is actually simpler than Basic), but the MLM is there if and when you need it.

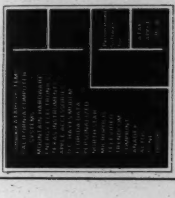
SOFTWARE

Software is where it's really at — without good software, even the most sophisticated personal computer will look dumb. One of the most important factors one must consider when trying to decide on a personal computer is the availability and quality of software. No one person has the time and ability to program everything; the best you can hope to do is accept the specific challenges which fit your own interests and capabilities. Many fine products (see advertisements in this issue) are available commercially. These cover a range from action games (*Breakout, Space Invaders, Zap,* etc.), to more serious games (*Microchess, Backgammon, 1000 Miles,* etc.); from relatively simple applications programs to complete systems (various assemblers, word procesors, financial and business packages, educational packages, etc.). Obviously, the PET has no monopoly on good software nor even the largest share within the market. The point I am trying to make is just that software quality and availability is not a limiting factor in the utility of the PET.

Another aspect that deserves mention here is the fact that the PET has attracted a body of personal programmers who, I believe, are unsurpassed in imagination, cleverness, and willingness to share the results of their expertise. I don't feel it is appropriate, nor that I am even qualified to mention names, but I would advise the reader to scan the various personal computer magazines and journals to make their acquaintance. The people at Commodore have, perhaps justifiably, not revealed much of the inner workings of the PET (this situation is steadily improving due to the unrelenting commitment of certain Commodore staff members). However, the active community of PET users has done an essentially complete analysis on their own. There is indeed much "hidden gold" within the PET but unfortunately there is no one place where it is documented fully.

In summary, I would say that you really can't go wrong if you choose the PET as your personal computer. My own experience has been excellent in terms of reliability and capability. The PET shows no signs of obsolescence, and continues to be a popular machine. In all fairness, in case it hasn't been clearly stated above, I should restate what I feel are the PET's main weaknesses; its limited graphics, lack of a built-in RESET switch, and incomplete Commodore documentation. In my opinion, its main strengths are; good Basic operating system, advanced screen editor, good hardware/firmware marriage, IEEE-488 support, and broad based software availability. ☐

AT LAST ..



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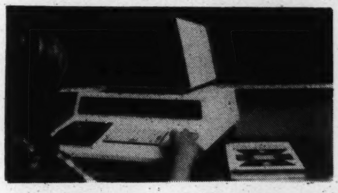
Q. Your students are gathering around the several PET computers in your classroom. And they all are hungry for hands-on turns at the keyboards. Some students are just beginning to understand computers; others are so advanced they can help you clean up the programs at the end of the period. How do you set up a job queue, how do you keep the beginners from crashing a program, how do you let the advanced students have full access? And how do you preserve your sanity while all this is going on?



A. With the Regent.

Q. What is the Regent?

A. The ultimate in classroom multiple PET systems. A surprisingly inexpensive, simple, effective way to have students at all levels of computer capability work and learn on a system with up to 15 PETs while the instructor has complete control and receives individual progress reports.

Q. SUB-it? Proctor? What are they?

A. **The SUB-it** is a single ROM chip (on an interface board in the case of the original 2001-8 models) that allows up to 15 PETs to be connected to a common disk via the standard PET-IEEE cables. The Commodore 2040, 2050 or 8050 dual disks and a printer may be used.

The SUB-it prevents inadvertant disruption when one unit in a system is loading and another is being used.

The Proctor takes charge of the bus and resolves multiple user conflicts. Each student can load down from the same disk but cannot inadvertently load to or wipe out the disk. Good for computer aided instruction

Q. How expensive are these miracles?

A. We think the word is **inexpensive**. The **Regent** system is **$250** for the first PET; **$150** for each additional PET in the system. The **SUB-it** is **$40**. (Add an interface board at **$22.50** if the PET is an original 2001-8.) And the **Proctor** is $95.

Phone or write for information. We'll be delighted to answer any questions and to send you the complete information package.

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creative computing
EQUIPMENT PROFILE

The CBM 2022 Smart Printer

A Second Look And Guide to the Control Codes

Roger C. Crites

Note: This interesting printer uses the PET Bus — 488 or IEEE Bus — and unfortunately, won't hook to most personal computers. Still, we thought its features might pique even the PETless.

I was very much surprised at the evaluation of the Commodore CBM 2020 printer published in *Creative Computing*, May 1980, "A Printer For Your PET — From Commodore?" I use a 2022 daily in the preparation of technical reports, and in the generation of graphs and plots. My experience and the May evaluation agree on only two points. First, the printer is well built. Second, the 7x6 character font limits the effectiveness of single-line reverse field output.

Allowing the customer to unravel the sometimes mysterious behavior of his new equipment all by himself gives him a glowing sense of accomplishment and personal achievement. Well, maybe — but if he is trying to achieve some particular objective in limited time, it can also give him ulcers.

Conspicuous by its absence was any description of the 2022's special features — specifically, formatted output, programmable line spacing, a programmable character, automatic paging with programmable lines per page, and others. If the purpose of an equipment profile is to aid the perplexed buyer, then a more objective approach seems essential.

Because the CBM 2022 is worth serious consideration by anyone in the under-$1000 market, because an objective description of the 2022 is lacking, and because clear documentation is elsewhere unavailable, I am offering a second look at this fine little printer.

Admittedly, it lacks documentation. The user manual (with errata sheets) is better than the documentation furnished with the early PETs, but not much. As with the PET, there is a lot more capability built in than Commodore took the time to explain adequately.

Possibly Commodore feels they are doing their customers a great service. Allowing the customer to unravel the sometimes mysterious behavior of his new equipment all by himself gives him a glowing sense of accomplishment and personal achievement. Well, maybe — but if he is trying to achieve some particular objective in limited time, it can also give him ulcers.

Before putting on my objective-analysis hat, I would like to deal with a couple of impressions given by the May equipment profile. First, the 2022 is portrayed as an extremely noisy printer. Well, noisy is as noisy does. My study is located in a spare bedroom. In the adjacent bedroom two of my daughters sleep undisturbed while my 2022 spits out page after page. Compared to thermal or electrostatic printers, the 2022 may be judged noisy. Compared to other impact printers, since that's what 2022 is, it is not noisy at all.

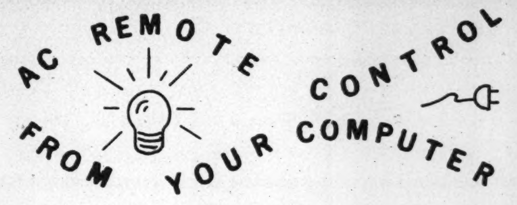
Secondly, the impression is given that changing or loading paper is a cumbersome task — removing screws, lifting the upper housing, etc. Possibly the unit evaluated was an early prototype (which might also explain the noise). In any case, this impression is incorrect. Standard fanfold paper is loaded very quickly and easily from the top. It is not necessary to remove any screws or lift the upper housing. Changing from standard data processing forms to graph paper, etc., can be accomplished in a matter of seconds with no tools required.

Print Head and Printing Modes

Now, down to business. The CBM 2022 is an 80-column serial impact dot-matrix printer. A heavy-duty Epson 7-wire print head (with a life expectancy of 100 million characters) outputs a 6x7 character font.

commodore
CBM
Model 2022
tractor
printer

Roger C. Crites, 11880 Rio Grande, St. Louis, MO 63138.



AIM65

Data Acquisition

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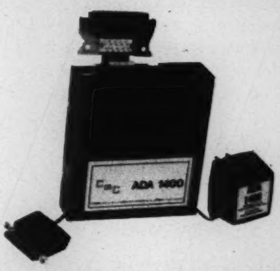
PET Printer Adapter



CmC's ADA 1400 drives a printer with an RS-232 interface from the Commodore PET IEEE-488 bus. The ADA 1400 is addressable, works with the Commodore disk and prints upper and lower case ASCII.

A PET IEEE type port is provided for daisy-chaining other devices.

A cassette tape is included with programs for plot routines, data formatting and screen dumps. The ADA 1400 sells for $179.00 and includes a PET IEEE cable, RS-232 cable, power supply, case, instructions and software.

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PET PRODUCTS

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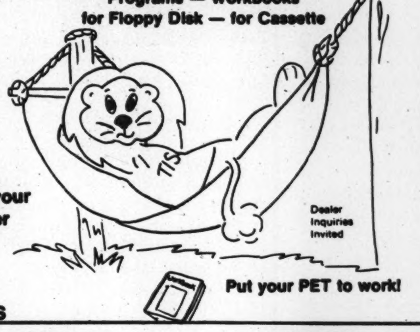

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SW-4	MEDIT create and maintain data files
SW-5*	CALENDAR appointments, meetings at a glance

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WB-1	Getting Started with Your PET	$3.95
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WB-4	PET Cassette I/O	$4.95
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WB-6	PET Control and Logic	$3.95

*These programs are special purpose data base management systems. They all can:

- Sort numeric or string fields
- Select based on numeric or string (=)
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Prices: $9.90 each for programs using cassette storage for data
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CIRCLE 249 ON READER SERVICE CARD

2022, cont'd...

The ribbon spool is similar to a typewriter spool, but the ribbon itself is a special heavy duty nylon-fibered material. It has a life expectancy of 4 million characters. The print-head strikes only the upper half of the ribbon, and after an estimated 2 million characters it is necessary to flop the ribbon to expose the unused lower half. Wire-impact force and print-head clearances will receive any standard (5/32 x .5) pin feed paper or forms ranging in width from about 1 inch to 9.5 inches (which tears to the popular 8-1/2 width.)

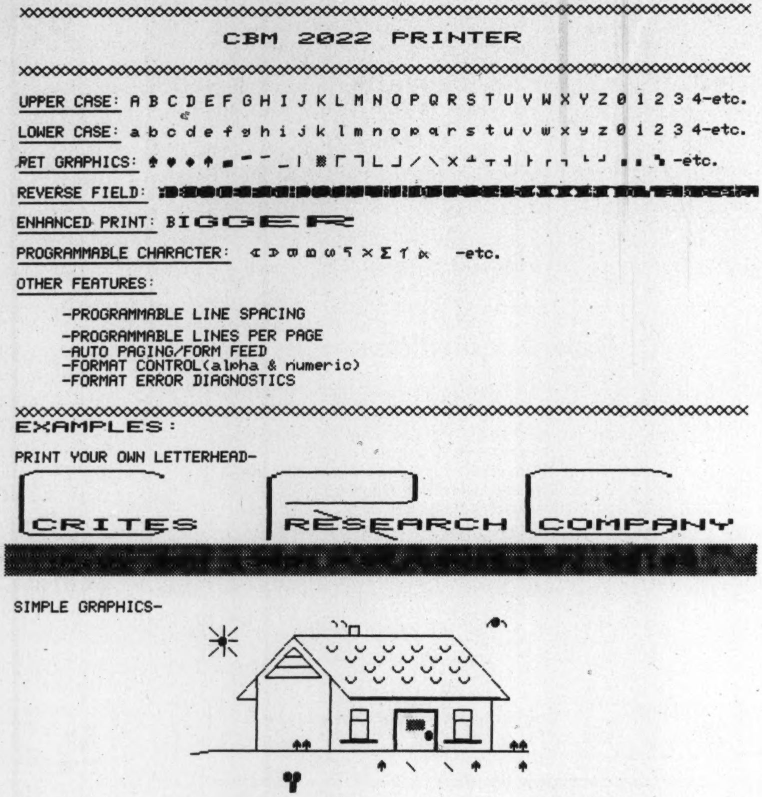
The user may operate the 2022 in full dot-by-dot mode through a programmable character (explained later). This dot-by-dot control, used while sweeping the print-head with no gaps between the lines, allows you to emulate a digital plotter. the resolution of the 2022 in this mode is about 0.017 inches. However, line-to-line repeatability in print-head trajectory and timing results in an uncertainty of about .010 inches in dot placement. With this kind of slop, the 2022 is obviously not going to displace Versatec or Calcomp; nevertheless, with a programmable character (in addition to the PEt graphics characters), acceptable plots can be made.

Standard character size is 0.;100 wide by 0.110 high. While there is a full lower case, lower-case letters do not have true descenders on this machine (see sample).

An enhanced print mode is incorporated. In this mode an "enhancement" code is prefixed to the output string. The result is a boldface, double width print, which is very useful for headings.

CHR$(1) prefixed to the output string is the enhancement code that widens characters that follow. An "unenhance" character, CHR$(129), can be inserted to terminate enhanced mode anywhere in a string. Enhanced mode is also terminated by a carriage return.

Multiple enhancement characters may be prefixed, resulting in bolder and bolder print. The real limit on this enhancement is legibility. The characters get wider, but not higher. For example, a string prefixed with 9 enhancement codes would print about 1 inch wide characters, but they would still be only .11 inches high. (While such exaggerated print has little use in reports, it can be used with graphic characters to produce some interesting three-dimensional illusions.)



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xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
                          CBM 2022 PRINTER
xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

UPPER CASE: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 0 1 2 3 4-etc.

LOWER CASE: a b c d e f g h i j k l m n o p q r s t u v w x y z 0 1 2 3 4-etc.

PET GRAPHICS: ♠ ♥ ♦ ♣ ▬ ▔ ‾ _ | ▒ ┌ ┐ └ ┘ / \ X ┴ ┬ ┤ ├ ┌ ┐ └ ┘ ▪ ▪ ▚ -etc.

REVERSE FIELD: ██████████████████████████████████████████████████████

ENHANCED PRINT: BIGGER

PROGRAMMABLE CHARACTER:  « » ϖ ϖ ω ¬ × Σ ↑ ∝   -etc.

OTHER FEATURES:

     -PROGRAMMABLE LINE SPACING

     -PROGRAMMABLE LINES PER PAGE
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     -FORMAT ERROR DIAGNOSTICS

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SIMPLE GRAPHICS-
```

Embedded Control Characters

The printer may be controlled in two ways. The simple method is by inserting transparent control characters in the print string. The first two of these, enhance — CHR$(1)-and unenhance — CHR$(129)-have been mentioned.

Uppercase is CHR$(145), lowercase is CHR$(17).

Reverse field On-CHR$(18)-indicates that following characters are to be printed in reverse field. Reverse Field Off — CHR$(146)-terminates reverse field output.

A Carriage Return — CHR$(13)-performs a carriage return/line feed, and also terminates enhancement, reverse field, and lower case operation. Carriage Return with No Line Feed — CHR$(141)-permits overprinting the same line. Line Feed — CHR$(10)-produces one line feed.

Auto-Paging On — CHR$(14)-functions with the number of lines per page (written to control file 3; see below) to index a top of form. When auto-paging is on, the 2022 counts lines and automatically inserts line-feeds to avoid printing on the page-separation perforations.

Paging Off/Form Feed — CHR$(19)-uses the *previous* top-of-form index to perform a form-feed, and then inhibits auto-paging. Auto-paging must again be selected, if desired, after every form feed.

SkipSpace — CHR$(29) and Quote — CHR$(34)-complete the special control characters. Most of these may be implemented with the PET by use of the cursor control and screen control keys.

Secondary Address, or "Control Files"

The 2022 is also controlled by writing to appropriate secondary printer addresses. With a PET this is done by simply opening "control files", actually certain associated secondary addresses, and then writing the desired control codes into these files. There are 5 control files, or addresses, in the 2022, whose secondary addresses are 2 to 6.

Auto-Formatting

A print format is specified to the printer by writing to a control file with a secondary address of 2. There are several format options with considerable flexibility of implementation. String literals may be embedded in format statements. These literals are printed with the output data in the indicated location.

The predefined format may be switched on and off depending on the secondary address of data to be printed.

Data output to the printer having only the secondary address of zero are printed exactly as received; this is the default value. Data output with a secondary address of 1 are first processed by the printer according to a previously defined format. Both alpha and numeric data can be formatted.

Special forms can also be created by overprinting a line. That is, using appropriate graphics you can print the form lines or divisions and then send a carriage return without a line feed. The output data is then, under format control, printed over the same line.

By using embedded literals, the printer may additionally create a special data form about the data as it is tabulated. Indeed, it is quite easy to instruct the *printer* to format the output data, truncating numbers (for instance) to the specified number of decimal places and aligning them into columns.

In case a format statement doesn't process the output as expected, a format diagnostic printout can be enabled by writing into control file/secondary address 4. The printer will detect any formatting error and print out the format statement with a diagnostic message indicating the problem; an arrow is printed pointing to the offending code.

Paper Travel

Control files (or secondary addresses) 3 and 6 are used to specify the number of lines per page and the number of steps per line feed respectively. The paper advance mechanism has 144 steps per inch of paper travel. A number written to control file 6, specifies how far the paper rises with each line feed; for instance, writing "24" to control file 6 will advance the paper 24/144, or 1/6 of an inch. (This is the powerup default value, the standard 6 lines per inch.)

Any number of steps may be specified. Thus double spacing, triple spacing, half spacing, etc. can be selected. A value of 8 produces a line-feed of half a character height and is useful for printing subscripts on headings. A value of 16 will program the paper stepper to 16 steps per line feed or 16/144 of an inch. This value is equal to .111, or just one thousandth of an inch greater than the .110 character height.

This dot-by-dot control, used while sweeping the print-head with no gaps between the lines, allows you to emulate a digital plotter.

This is extremely useful for graphic output. The character dot matrix of adjoining lines just touch, producing a continuous print field.

The Special Character

A single programmable character can be specified as any combination of dots in the 6x7 matrix. This is programmed by writing to control file/secondary address 5.

Problems

The printer's operating system has a couple of bugs. Closing control files sometimes "listen" to the bus when they shouldn't. This is indicated by the red light on the paper-advance button. (When this happens, the *next* print statement is likely to be ignored.) This can be avoided by not closing control files until the end of the program, or by including dummy print statements after closing each control file.

Certain format statements also seem to produce unexpected results. This is not very common, but once in a while a format code will cause double line-feeds on every carriage return. Quite probably there are other bugs also, just waiting to be uncovered.

The way in which upper and lower case is implemented has some undesirable consequences when making program listings. If the program contains upper and lower case, *the listing is generated with all the lower-case characters replaced by graphics characters.* If the use of lower case is extensive, the listing is hard to decipher. If lower-case text is not used a great deal this will not be a problem. If it is, the only way to get readable listings is to use a translator program which inserts the lower-case control character into the print string when applicable.

Endorsement

All in all, the CBM 2022 is quite a printer for $995.00. But like the early PET, it takes a little individual experimentation to make it really perform. □

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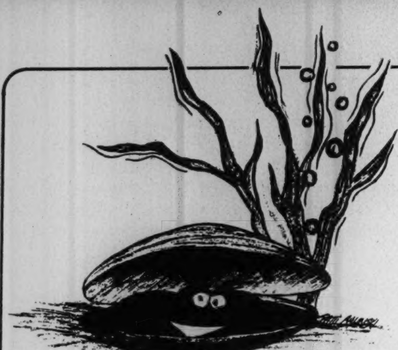


PEARL

David Lubar

(With a Lot of Help From Laura McLaughlin)

A program in Basic can cost as much as $6.00 a line for development and debugging. Since many businesses have similar needs, it would seem that a lot of work is being repeated in different places at a rather high cost. There should be a better way. Enter PEARL (Producing Error-free Automatic Rapid Logic). The review package we received was a sample of Level 2, designed for both programmers and laymen. Housed in a high-quality notebook, the system contained two 8-inch disks and over one hundred fifty pages of documentation. To get PEARL running, you need CP/M (a registered trademark of Digital Research), 48K of RAM, CBasic version, 2.03, and two disk drives with at least 150K capacity per disk. There is also a version configured for the TRS-80.

O.K., with that out of the way, the next question is, "What exactly does PEARL do?" PEARL creates programs for filing, editing, updating, and printing data. Let's say a company wants to keep track of customers, with information such as name, address, phone number, account number, and so on. PEARL will develop a program that manages the defined data file. Once the program has been developed, the user has a customized system, complete with prompts, error checks, and defaults.

Was it easy to use? Yes and no, but mostly yes. In a sense, we had the ideal conditions for a test. I had never used CP/M before, but there was someone on staff who had and could play the part of experienced programmer while I took the role of novice.

I left the first few steps to the pro. This consisted of setting up work disks, and configuring the disks. This was a snap for the pro. To quote her, "It's easy if you are at all familiar with CP/M." The configuration process also required a bit of knowledge concerning the equipment that was to be used. However, according to our programmer, the program provided for this task made it amazingly painless, with most of the popular terminals being pre-defined and the rest of the necessary information relatively straightforward.

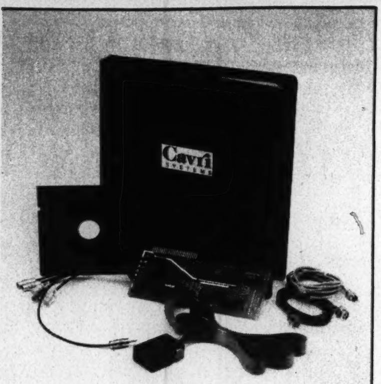
After that, the tyro can take over, though it is comforting to have a pro around to answer questions such as, "What do they mean by variable code word?" or "How do I make an edit mask?" Throughout the steps, the system displays menus and gives meaningful prompts for all questions. The user enters each field and its length, then specifies what kind of variable will be used, such as integer, floating point, string, date, and so on. The user may also indicate what, if any, editing should be performed and, if, once entered, the field should be protected. After all the fields have been defined, any arrays have to be defined. For example, if you want to use the numbers one through five to represent five different counties, you just have to tell PEARL what each number stands for. Later, when a report is generated, PEARL will replace the number with the correct information.

System generation and compilation take a while. The example we tried took about an hour and a half. Of course, you don't have to sit watching the screen while the compilation is in progress (though that is a great way to kill time and look busy). Once that part is done, the rest is a breeze. You get the program up by entering "run xxxx," using whatever name you gave it. In a few seconds, the menu will appear. Whenever input is about to be made in a field, the screen will show the last value used. This value will be kept if you press return. The program, once generated, ran with no problems, and was very easy to use.

The PEARL manual provided a lot of information for programmers who might want to make changes or add other programs or subroutines. Moreover, the generated CBasic code is clear, with abundant remarks. Documentation is included by program, showing subroutine entry points and giving a complete description of the program's function as well as the variables being used. There is also an explanation of the file structures implemented (both random and indexed-sequential).

Anyone who has need of this type of program could make good use of PEARL. You do need a programmer for some of the early steps, and for any desired modifications, but the programmer will only be tied up for a few hours. She won't have to spend days creating and debugging a system.

PEARL Level 2 is available from Computer Pathways Unlimited, Inc., 2151 Davcor St. S.E., Salem, OR 97302, at a cost of $350. □



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Creative Computing
SOFTWARE PROFILE

Comparative Evaluations of Basic Systems

M. Firebaugh, T. Fossum, P. Sorensen and W. Stone

I. Background and Method

Following the flood of small computer hardware has come a continual stream of Basic language systems. Some of these run under the Digital Research Corporation operating system CP/M for the 8080/Z80 family of personal computers and some are designed for specific personal computers.

We felt it would be instructive for us and valuable to potential computer users to compare several of these systems, measuring such properties as memory requirements, speed, error diagnostics, and quality of documentation. The method used was similar to that used in the comparative evaluation of small computer hardware published previously.[1,2] Software houses were invited to submit their Basic systems for evaluation with the understanding that they could review and comment on a draft version of the results.

Our evaluation results are summarized in the form of three tables. In Table I we present system characteristics, most of which should be available by a careful reading of well-written system documentation. Some characteristics were verified by short test programs. In Table II we present the results of five benchmark programs which were run to measure experimentally memory requirements, speed, and accuracy on each system. Finally, in Table III we present our evaluation of some of the more subjective features of each system, such as the quality of documentation, editing capabilities, and convenience.

We would stress that the purpose of this evaluation is not to rank these systems or to categorize any system as being "good" or "bad." Since individual needs as well as the prices of various Basic systems vary widely, a system appropriate for one application may be entirely inappropriate for another. In designing the benchmark programs we tried to achieve a balance of "typical" applications including sorting, number crunching, string manipulation, and tests of various functions and error responses. While this selection of benchmark programs was arbitrary and reflects our own experience, it probably produces a fairer test than would a single application program. Finally, to compare the present generation of small computer Basic systems to older and present generation minicomputer based systems, we include the results of running the benchmark programs on a Hewlett-Packard 2000 timesharing system and a Digital Equipment PDP-11/45 respectively.

II. Results

A. *Defined System Characteristics*

In Table I we present system characteristics as obtained from the software manuals. Such characteristics are clearly important considerations to users in selecting a software package. We did not list all special features available on each system.

B. *Measured System Characteristics—Benchmark Results*

In Table II we present the results of running our set of five benchmark programs. The CP/M system was implemented and the first four systems tested on an Altair 8800B with 48K of memory. The last six systems were tested, respectively, on a 48K APPLE II, a 32K Commodore PET, a 32K TRS-80, a North Star Horizon, a 128K HP-2000 time sharing system (in single-user mode), and a 64K PDP-11/45 under the RSTS/E system. To make the timing and memory requirement results meaningful, the benchmark programs run on each system were identical with the exception of minor system dependent instruction changes. A listing of the set of benchmark programs is available from the authors upon request. We summarize the function of each program below:

FCNEXR — Function exercising program. This program called system predefined functions including the trig functions, log and exponential functions, square root and power functions, and random number generator. The general algorithm was to repeat the process $y = f(x)$; $x = f^{1}(y)$ a number of times and compare the final result for x with the initial value of x. This gives some measure of the accuracy of the algorithm used in the function and the inverse function and should detect any significant error in either (unless the error in the function compensates precisely the error in the inverse function). The random number generator was tested by calculating the Nth moment x^N of the random number x and comparing this to the theoretically expected value of 1(N+1) for values of N up to 10. Since the accumulated errors were consistent with round-off

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M. Firebaugh, T. Fossum, P. Sorensen, and W. Stone, University of Wisconsin-Parkside, Kenosha, WI 53141

Work supported in part by the Center for the Application of Computers University of Wisconsin-Parkside, Kenosha, Wisconsin.

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TABLE I(a): DEFINED SYSTEM CHARACTERISTICS

System	Version Tested (Date)	List Price	System Memory Requirement	Maximum Symbolic Variable Length (#Significant Characters)	Integer Arithmetic ?	Multi-Statement Functions ?	Function Recursion[1] ?
CBASIC	2.04 (©1978)[2]	$100-140	20K Compiler 17K Runtime	Unlimited (31)	yes	yes	no
MICROSOFT	5.01(7-23-79)	$350	24K	40(40)	yes	no	no
TARBELL	12.14(8-6-79)	$50	24K	23(23)	yes	yes	yes
OPUS	2.3C(©1978)	$99-195	24K	72(72)	no	yes	yes
APPLESOFT II	DOS 3.2 plus (©1979)	$200 (firmware card)	10K ROM or 16K RAM	238(2)	yes	no	no
COMMODORE PET	2001-32N(6-79)	$1200 with hardware	16K	80(2)	yes	no	no
TRS-80	2.3(©1979)	comes with hardware	22K	255(2)	yes	no	no
NORTH STAR	DOS 4.0	comes with hardware	13K	2(2)	no	yes	yes
HP-2000 TS	1976	comes with hardware	28K BASIC complete sys.	2(2)	no	no	no
BASIC-PLUS	RSTS/E V 7.0	comes with RSTS/E sys.	64K for complete operating sys.	30(30)	yes	yes	yes

[1] This feature allows a function to call itself.
[2] The current versions of CBASIC are 2.05 for CRUN2 and 2.03 for CBAS2.

TABLE I(b): DEFINED SYSTEM CHARACTERISTICS - (continued)

System	Multi-Statement Lines?	Line-by Line Syntax Check?	String Arrays ?	Error Message Format	Statement Number Format	Variable Dimension Default	Floating Pt. Mantissa Precision
CBASIC	yes	yes (compile time)	yes (255 char. deep)	2 letter code 37 for compile 51 for runtime	optional - any floating point #	none	14
MICROSOFT	yes	no (only at runtime)	yes (88 char. deep)	full phrase	required 0-65K	11	7 single prec. 16 double prec.
TARBELL	yes	yes	yes	40 short word mnemonics	optional - any alpha numeric string	none	8
OPUS	yes	no	yes	minimal execution error messages	optional - numeric	none	2-55 under program control
APPLESOFT II	yes	no (only at runtime)	yes (256 char. deep)	17 2-3 word messages	required - 0-65K	11	9
COMMODORE PET	yes	no (only at runtime)	yes (255 char. deep)	27 full phrases	required - 0-65K	11	9
TRS-80	yes	no (only at runtime)	yes (255 multi-dimension)	complete sentences	required - 0-65K	10	5.7 single prec. 15.9 double prec.
NORTH STAR	yes	no (only at runtime)	yes	26 2-3 word messages	required - 0-65K	10	8, 10, 12, or 14
HP-2000 TS	no	yes	no	complete sentences	required - numeric	10	6.9
BASIC-PLUS	yes	yes	yes	complete sentences	required - 0-32K	10	6 single prec. 15 double prec.

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TABLE I(c): DEFINED SYSTEM CHARACTERISTICS - (continued)

System	Floating Pt. Exponent Range	Floating Pt. Byte Requirements	Statement Renumbering Command?	Nested IF Structure?	Depth of Nested Subroutines	Assembly Language Linkage?	Formatted Output
CBASIC	-64 +63	8 BCD	not applicable	no	20	yes	yes
MICROSOFT	±38	4 binary, 8 double prec.	yes	yes	no limit specified	yes	yes
TARBELL	±99	6 BCD	no (line designators)	yes	no limit specified	yes	yes
OPUS	±63	3-30 BCD	yes	yes (block structure permitted)	no limit specified	yes	yes
APPLESOFT II	±38	5 binary	no	yes	24	yes	no
COMMODORE PET	±33	5 binary	no	yes	no limit specified	yes	no
TRS-80	±38	4 binary, 8 double prec.	yes	yes	no limit specified	yes	yes
NORTH STAR	±62	5 binary	yes	yes	no limit specified	yes	yes
HP-2000 TS	±38	4	yes	no	no limit specified	no	yes
BASIC-PLUS	±38	4 single prec., 8 double prec.	no	yes	no limit specified	no	yes

errors in every case, we conclude there are no obvious problems with the functions supplied with the systems under test.

QSORT — Sorting program. This program generated 300 random numbers and used the Quicksort algorithm[3] to rank them in increasing order.

MATINV — Matrix inverting program. This program used the synthetic elimination algorithm[4] to invert a N x N "Hilbert Matrix" [in which the element M(I,J) is defined as M(I,J) = 1/(I+J-1)]. The inverse matrix was then multiplied by the original matrix and the resulting matrix compared to the theoretically expected identity matrix [Id(I,J) = 1 for I = J; 0 otherwise]. The maximum deviation of the calculated result from the theoretical value for a 5 x 5 Hilbert Matrix is listed as the "Floating Point Accuracy" in Table II. The timing test results are based on the run time required to invert a 10 x 10 matrix.

STRMAN — String manipulating program. This program created a string and exercised some of the string manipulating subroutines, including CHR$, MID$, and concatenation.

ERRTST — Error testing program. This program simulated the most common errors made in Basic language programming and tested the error exit, defaults, and diagnostics. The general categories of errors tested included: dimension errors,

TABLE I(d): DEFINED SYSTEM CHARACTERISTICS - (continued)

System	Max. Number of Array Dimensions	Break Procedure	Number of String Functions	Peek and Poke Commands	Chaining and Common Variables?	Error Trapping?
CBASIC	no limit specified	none	10	yes	yes	on file errors
MICROSOFT	no limit specified	CTRL C	8	yes	yes	yes
TARBELL	no limit specified	CTRL C	15	yes	yes (no common variables)	no
OPUS	no limit specified	CTRL C	6	yes	yes	yes
APPLESOFT II	88	CTRL C	8	yes	yes (no common variables)	yes
COMMODORE PET	3	STOP CTRL C	8	yes	yes (no common variables)	no no
TRS-80	no limit specified	CTRL C Break	9	yes	yes	yes
NORTH STAR	no limit specified	CTRL C	7	yes	yes (no common variables)	yes
HP-2000 TS	2	Break	--	no	yes	yes
BASIC-PLUS	2	Break CTRL C	23	yes	yes core common area	yes

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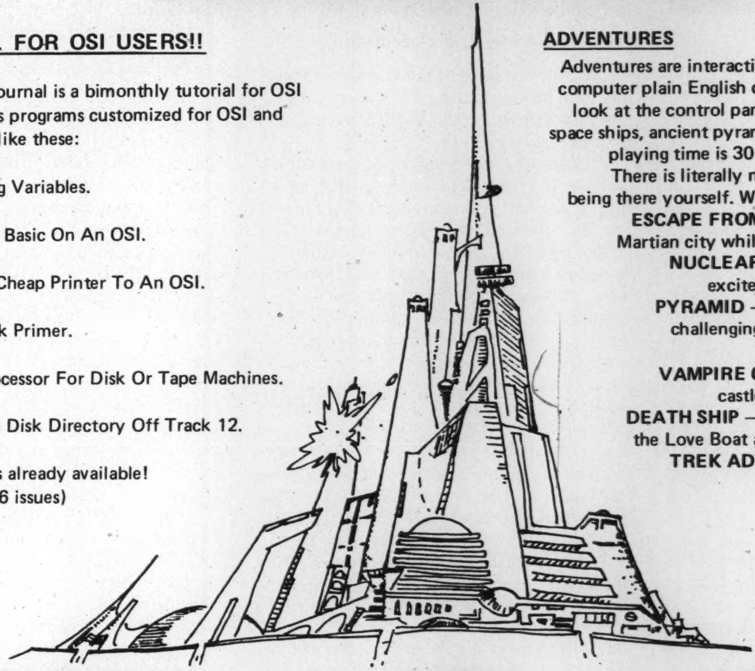

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Comparative, cont'd...

assignment errors, arithmetic errors, function errors, program structure errors, and miscellaneous errors such as exit procedure from a tight loop. Since this program was purely diagnostic, no timing test was run on it.

C. *System Evaluation*

In Table III we present a subjective evaluation of each system based upon our experience in working with it. Most of the characteristics listed in the evaluation summary should be self-explanatory. However, we should comment briefly on the "Transportability of Dialect" category. Here we are concerned with two questions. By outward transportability, we mean "How easy is it to convert programs written under this system to other Basic systems?" By inward transportability, we mean "How easy is it to convert Basic programs written elsewhere to this system?" The answers to both questions clearly depend on what systems are under consideration.

We raise the transportability issue because we believe potential users should be keenly aware of both the advantages and disadvantages of highly-touted "extended features" of various Basic systems. The advantages include the additional power and flexibility which such features provide. The primary disadvantage must be the system-dependent nature of programs incorporating these extended features. Potential users should recognize that the more extended features a given Basic system offers, the more difficult will be the task of converting resulting programs to other Basic operating systems. In general, the closer the Basic system adheres to the new ANSI Minimal Basic standard, the easier the job of transporting programs into and away from the systems will be.

III. Observations and Conclusions

Below we present some observations and conclusions based on the results tabulated above and our experience in working with each system.

Cbasic — The strengths of this system include its compiler structure and very high precision. As a compiler, it optimizes the use of memory (but not necessarily speed) and is a good system for designing commercial end-user programs. However, since it requires separate processors for editing, compiling, and running, it does not lend itself easily to frequent program changes. This makes program development and debugging inconvenient, although it does have a good set of error messages.

Microsoft — This is an excellent, all-purpose system. Its availability on most hardware systems and adequate customer support have helped make it the standard of the industry. It performed well on all tests but was the most expensive system evaluated.

Tarbell — Several unique features make this interesting system potentially one of the most powerful of those tested. These include flexible I/O features and a line descriptor label format which provides a clear "assembly-language-like" logical structure to programs. The system is also the least expensive of those tested, and the source program is available for modifications and deletions. On the negative side, the documentation was minimal, our system was prone to crashes, and the benchmark programs required the most memory space of any system tested.

Opus — This system, although technically not a true Basic language, has its roots in Basic. With its well-designed block structure and string labels for logic control, it provides the best capability for implementing well-structure end-user application programs of all the systems tested. Other unique features include no distinction between string and numeric variables, and programmer-controlled precision of up to 55 digits. It is not a good language for beginners, and the error detection and diagnostics have not reached the sophistication of the structured programming concepts. Run time error detection is essentially incomprehensible, which makes debugging long programs difficult. The extended features greatly reduce the transportability of programs written in OPUS. Our test results indicate it was the slowest program in execution. However, it is a powerful language and we agree with its author that it "both challenges and rewards the programmer."

Applesoft II — This is the extended, floating-point Basic which we ran under DOS Version 3.2 on one of the popular Apple II Plus computers. This version is Microsoft's Basic extended by Apple to include commands for low- and high-resolution graphics, analog game control input, and speaker output. These commands have been incorporated in a very natural way. In general this system is very convenient to use. It performed extremely well in the speed and accuracy tests and about average in program memory requirements. Because of the extensive, well-written documentation and convenient implementation, this system is well suited

TABLE I (e): DEFINED SYSTEM CHARACTERISTICS - (continued)

System	Random Access of Files	Nested Loop Depth	Number of Key Words	Trace Features	Special Features
CBASIC	yes	no limit	92	yes line # option	compiled
MICROSOFT	yes	no limit	80	yes	
TARBELL	yes excellent file commands	no limit	110	none indicated	line descriptors - assembly like flexible I/O facility
OPUS	yes	no limit	94	yes single step option	block structure, multiple precision arithmetic
APPLESOFT II	yes	10 levels	106	yes	color graphics, analog inputs, TTL I/O Ports, Tone generator
COMMODORE PET	theoretically, but bugs remain	10 levels	71	no	real time clock, graphics character set, screen editor
TRS-80	yes	no limit	89	yes	black and white graphics
NORTH STAR	yes	no limit	73	yes	extensive business applications software available
HP-2000 TS	yes	no limit	---	no	excellent diagnostics, extensive system library
BASIC-PLUS	yes	no limit	238	yes	excellent diagnostics, extensive system library

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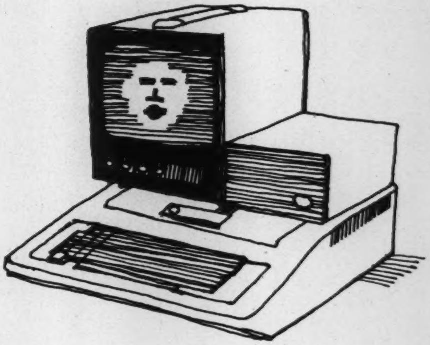

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Comparative, cont'd...

TABLE II: MEASURED SYSTEM CHARACTERISTICS - BENCHMARK RESULTS

System	Program Size - No. of Bytes Before Run (No. of bytes after run)					Program Run Time (sec)				Floating Pt. Accuracy (Matrix Test, N=5)
	FCNEXR	QSORT	MATINV	STRMAN	ERRTST	FCNEXR	QSORT	MATINV	STRMAN	
CBASIC	1339	597	1679	492	4309	695	62	164	106	4 E-9
MICROSOFT	1747 (1862)	1095 (3602)	1613 (10,326)	895 (6831)	6161 (6201)	68	80	90	114	5.9 E-3
TARBELL	2786 (2953)	1966 (5646)	3972 (7572)	1352 (1425)	9268 (9474)	293	103	96	138	2.0 E-3
OPUS	- - - - - - - - - - Not Available - - - - - - - -					1853	319	413	226	5.3 E-3(8 digit accuracy)
APPLESOFT II	1601 (1768)	1081 (4154)	1604 (12,448)	849 (904)	5642 (5746)	62	56	55	63	1.2 E-5
COMMODORE PET	1706 (1902)	1140 (4203)	1792 (12,636)	904 (966)	6075 (6133)	70	68	67	82	1.2 E-5
TRS-80	1668 (1800)	1200 (3600)	1270 (1854)	923 (1024)	Not Available	76	94	92	134	5.9 E-3
NORTH STAR	1790	1057	1792	904	5632	67	46	41	49	1.0 E-3
HP-2000 TS	1670	1240	1398	942	5988	6.5	20	17	70	7.8 E-3
BASIC-PLUS	8192 (8192)	6144 (12,288)	8192 (12,288)	6144 (6144)	Not Available	6	7	9	20	1.4 E-12

for both the beginner and expert interested in serious computing.

Commodore Pet Basic — This language was written by Microsoft for Commodore. It includes therefore, most of the language features which have made Microsoft Basics the industry standard. The performance of this version of Basic is very similar to other Microsoft-generated dialects. Some programs run a little slower, but this is probably due to the fact that Commodore Basic is a real-time interrupt driven language. This aspect is a powerful one since certain interrupt vectors are maintained in volatile RAM memory and may be changed by user software. The most significant feature of this version of Basic is the screen editor which makes changing programs far easier than on many other systems.

TRS-80 Basic — This system was originally developed by Microsoft for the very popular Radio Shack computer. One of the primary advantages of the system is the excellent, nationwide support provided through company owned Radio Shack stores and a majority of the dealerships. New system update diskettes are provided without cost as they appear. The system has a full text editor, easy assembly link-

TABLE III(a): SYSTEM EVALUATION

System	Built-in Function Performance	Error Identification and Diagnostics	Quality of External Documentation Reference Manual	Quality of External Documentation User's Guide	Ease of Editing
CBASIC	Slow execution, high precision	Good, with two letter coded message	good	minimal	none
MICROSOFT	Satisfactory, single precision only	Good, with adequate diagnostics	good	good	very good
TARBELL	Slow execution, approx. 6 digit precision	Some errors undetected, otherwise good error detection, descriptive error messages	fair	minimal	excellent flexibility prone to crash, documentation poor
OPUS	Slow execution, approx. 6 digit precision	Errors detected but not easily identified	good	good	retype line
APPLESOFT II	Satisfactory	Good error detection, appropriate diagnostics	excellent	good	excellent screen editor
COMMODORE PET	Satisfactory	Good detection, adequate diagnostics	good	fair	excellent screen editor
TRS-80	Satisfactory, single precision only	Good, with adequate diagnostics	excellent	good	very good, adequate screen editing, minimal documentation
NORTH STAR	Satisfactory	Good detection, adequate diagnostics	excellent	good	very good line editor
HP-2000 TS	Satisfactory, approx. 6 digit precision	Good error detection, complete diagnostics	excellent	good	retype line
BASIC-PLUS	Fast execution, high precision	Good error detection, complete diagnostics	excellent	good	retype line or use excellent text editor

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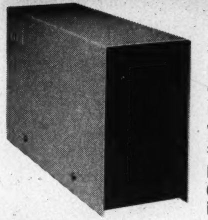

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Comparative, cont'd...

TABLE III(b): SYSTEM EVALUATION - (continued)

System	Ease of Code Documentation	Convenience	Transportability of Dialect	
			Outward	Inward
CBASIC	Remarks allowed in source file, flexible statement format	Poor - separate processor for edit, compile, and run	Fair	Good
MICROSOFT	Standard REM statements	Excellent	Excellent	Excellent
TARBELL	Easy to set off blocks of code, standard REM statements	Good - editing is confusing and prone to crashes	Poor - due to "line descriptors" (see special features)	Excellent - designates lines in error
OPUS	Flexible standard REM statements allow structured programming, but use of spaces is confusing	Good	Poor	Fair
APPLESOFT II	Standard REM statements	Good disk operating system	Good - except for color graphics	Very good
COMMODORE PET	Standard REM statements	Inconvenient disk operating system	Good - except for graphics and I/O	Very good
TRS-80	Standard REM statements	Excellent	Excellent	Excellent
NORTH STAR	Standard REM statements	Excellent	Excellent	Fair
HP-2000 TS	Standard REM format limited to entire line	Excellent	Excellent	Fair
BASIC PLUS	Standard REMs, append comments with "!", embedded comments allowed	Excellent	Excellent	Excellent

age, and variable pointers which simplify program modification. Some of the early hardware problems with key contact bounce have been solved by the use of silicone spray treatment and software modification. The expansion interface bug detected in the unit used for this evaluation was corrected free of charge in three days at the area service store.

North Star Basic — This system was implemented by Charles Grant and Mark Greenberg of North Star Computers, Inc. It is a well documented system, similar in style to the HP Basic, and has a very simple and convenient line editor. It was an early entry into the personal computer field, in conjunction with the North Star mini-floppy disk. Consequently, much software exists in North Star Basic. The system is available on disk in 8, 10, 12, or 14 digit integer precision, and the smallest version requires 11.5K of memory. The efficient disk operating system provides relatively fast and quiet file access.

HP-2000 TS Basic — This older generation minicomputer-based system was designed specifically to execute Basic efficiently in a time-sharing environment and serves 32 users. It has been superceded by the HP-3000 series of computers with which it is downwardly compatible. It is a very simple and convenient system to use, but the HP Basic does not have many of the convenient extended features available on most small computers.

PDP-11/45 Basic-Plus under RSTS/E — Basic-Plus is one of the finest Basic languages available. It is implemented on the PDP-11/45 under a time-sharing operating system. It is well suited for the beginner because it is convenient and easy to use as well as for the expert interested in serious programming because of the advanced features provided. An easily implemented "EXTEND" option provides this powerful extension, but seriously reduces the outward transportability of resulting programs. There is extensive external documentation and excellent utility program support.

The data presented here may be useful to programmers interested in comparing Basic systems. The features evaluated will be of interest for many user applications, but the scope of the study did not permit investigation of such important areas as file management and program optimization using integer arithmetic. Reference 5 presents a thorough discussion of software interpreters, and References 6-8 present other evaluations of small computer software systems.

IV. Acknowledgements

We wish to thank a number of persons who helped us on this project. In particular we want to thank the following for running the benchmark programs and assisting in the evaluation: Mark Kleine, UW-Parkside student, on the TRS-80; Dr. Don T. Piele,, UW-Parkside mathematics professor, on the North Star Horizon; Dr. Howard R. Gage, mathematics professor at Whitworth College, Spokane, WA, on Basic-Plus; and Jim Dunion of the American Museum of Science and Energy in Oak Ridge, TN, on the Commodore PET. We appreciate the suggestions and comments of our UW-Parkside colleagues Ron Gatterdam and Ming Kuo and our colleagues Dave Boyd and P.R. Bell at the Oak Ridge Institute for Energy Analysis where much of this work was done. We appreciate the excellent support of IEA secretary Ms Janet Kile.

Finally, we appreciate the cooperation of the distributors of Cbasic, Microsoft, Tarbell, and Opus for making these systems available for this evaluation. □

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The Electronic Cottage

Alvin Toffler

Alvin Toffler gave the world a new phrase and a new way of thinking when he introduced *Future Shock*. Now he takes an optimistic look at the future in *The Third Wave*. According to Toffler, the "First Wave" of change to transform human history was the agricultural revolution of some 10,000 years ago, and the "Second Wave" of about 300 years ago was the industrial revolution. The changes brought about by the "Third Wave", he believes, will provide startling opportunities for a better life for most people. A major factor in the changing world is, of course, the computer. Following are Toffler's views on this subject, excerpted from *The Third Wave*. Stand back or dive in, the choice is yours.

Hidden inside our advance to a new production system is a potential for social change so breathtaking in scope that few among us have been willing to face its meaning. For we are about to revolutionize our homes as well.

Apart from encouraging smaller work units, apart from permitting a decentralization and de-urbanization of production, apart from altering the actual character of work, the new production system could shift literally millions of jobs out of the factories and offices into which the Second Wave swept them and right back where they came from originally: the home. If this were to happen, every institution we know, from the family to the school and the corporation, would be transformed.

Watching masses of peasants scything a field three hundred years ago, only a madman would have dreamed that the time would soon come when the fields would be depopulated, when people would crowd into urban factories to earn their daily bread. And only a madman would have been right. Today it takes an act of courage to suggest that our biggest factories and office towers may, within our lifetimes, stand half empty, reduced to use as ghostly warehouses or converted into living space. Yet this is precisely what the new mode of production makes possible: a return to cottage industry on a new, higher, electronic basis, and with it a new emphasis on the home as the center of society.

To suggest that millions of us may soon spend our time at home, instead of going out to an office or factory, is to unleash an immediate shower of objections. And there are many sensible reasons for skepticism. "People don't want to work at home, even if they could. Look at all the women struggling to get *out* of the home and into a job!" "How can you get any work done with kids running around?" "People won't be motivated unless there's a boss watching them." "People need face-to-face contact with each other to develop the trust and confidence necessary to work together." "The architecture of the average home isn't set up for it." "What do you mean work at home—a small blast furnace in every basement?" "What

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about zoning restrictions and landlords who object?" "The unions will kill the idea." "How about the tax collector? The tax people are getting tougher on deductions claimed for working at home." And the ultimate stopper: "What, and stay home all day with my wife (or husband)?"

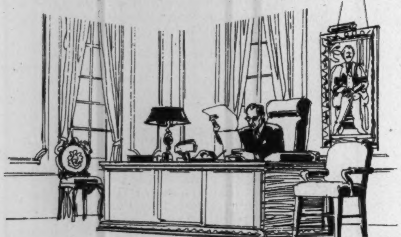
Even old Karl Marx would have frowned. Working at home, he believed, was a reactionary form of production because "the agglomeration in one workshop" was "a necessary condition for the division of labor in society." In short, there were, and are, many reasons (and pseudoreasons) for regarding the whole idea as silly.

DOING HOMEWORK

Yet there were equally, if not more, compelling reasons three hundred years ago to believe people would never move *out* of the home and field to work in factories. After all, they had labored in their own cottages and the nearby land for 10,000 years, not a mere 300. The entire structure of family life, the process of child-rearing and personality formation, the whole system of property and power, the culture, the daily struggle for existence were all bound to the hearth and the soil by a thousand invisible chains. Yet these chains were slashed in short order as soon as a new system of production appeared.

Today that is happening again, and a whole group of social and economic forces are converging to transfer the locus of work.

To begin with, the shift from Second Wave manufacturing to the new, more advanced Third Wave manufacturing reduces, as we just saw, the number of workers who actually have to manipulate physical goods. This means that even in the manufacturing sector an increasing amount of work is being done that—given the right configuration of telecommunications and other equipment—could be accomplished anywhere, including one's own living room. Nor is this just a science fiction fantasy.



When Western Electric shifted from producing electromechanical switching equipment for the phone company to making electronic switching gear, the work force at its advanced manufacturing facility in northern Illinois was transformed. Before the changeover, production workers outnumbered white-collar and technical workers three to one. Today the ratio is one to one. This means that fully half of the 2,000 workers now handle information instead of things, and much of their work can be done at home. Dom Cuomo, director of engineering at the Northern Illinois facility put it flatly: "If you include engineers, ten to twenty-five percent of what is done here could be done at home with *existing* technology."

Cuomo's manager of engineering, Gerald Mitchell, went even further. "All told," he stated, "600 to 700 of the 2,000 could *now*—with existing technology—work at home. And in five years, we could go far beyond that."

These informed "guesstimates" are remarkably similar to those made by Dar Howard, manufacturing manager of the Hewlett-Packard factory in Colorado Springs: "We have 1,000 in actual manufacturing. Technologically, maybe 250 of them could work at home. The logistics would be complicated, but the tooling and capital equipment would not prevent it. In white collar research and development, if you're willing to invest in [computer] terminals, one half to three quarters could also work at home." At Hewlett-Packard that would add up to an additional 350 to 520 workers.

All told, it means that fully 35 to 50 percent of the entire work force in this advanced manufacturing center could even now do most, if not all, their work at home, providing one chose to organize production that way. Third Wave manufacturing, Marx notwithstanding, does not require 100 percent of the work force to be concentrated in the workshop.

Nor are such estimates found in electronic industries alone or in giant enterprises. According to Peter Tattle, vice-president of Ortho Pharmaceutical (Canada) Ltd., the question is not "How many can be permitted to work at home?" but rather, "How many *have* to work in the office or factory?" Speaking of the 300 employed in his plant, Tattle says: "Fully 75 percent could work at home if we provided the necessary communications technology." Clearly, what applies to electronics and pharmaceuticals also applies to other advanced industries.

If significant numbers of employees in the manufacturing sector could be shifted to the home even now, then it is safe to say that a considerable slice of the white-collar sector—where there are no materials to handle—could also make that transition.

Indeed, an unmeasured but appreciable amount of work is already being done at home by such people as salesmen and saleswomen who work by phone or visit, and only occasionally touch base at the office; by architects and designers; by a burgeoning pool of specialized consultants in many industries; by large numbers of human-service workers like therapists or psychologists; by music teachers and language instructors; by art dealers, investment counselors, insurance agents, lawyers, and academic researchers; and by many other categories of white-collar, technical, and professional people.

These are, moreover, among the most rapidly expanding work classifications, and when we suddenly make available technologies that can place a low-cost "work station" in any home, providing it with a "smart" typewriter, perhaps, along with a facsimile machine or computer console and teleconferencing equipment, the possibilities for home work are radically extended.

Given such equipment, who might be the first to make the transition from centralized work to the "electronic cottage"? While it would be a mistake to underestimate the need for direct face-to-face contact in business, and all the subliminal and nonverbal communication that accompanies that contact, it is also true that certain tasks do not require much outside contact at all—or need it only intermittently.

Thus "low-abstraction" office workers for the most part perform tasks—entering data, typing, retrieving, totaling columns of figures, preparing invoices, and the like—that require few, if any, direct face-to-face transactions. They could perhaps be most easily shifted into the electronic cottage. Many of the "ultrahigh-abstraction" workers—researchers, for example, and economists, policy formulators, organizational designers—require both high-density contact with peers and colleagues *and* times to work alone. There are times when even deal-makers need to back off and do their "homework."

Nathaniel Samuels, an advisory director of the Lehman Brothers Kuhn Loeb investment banking house, agrees. Samuels, who already works at home 50 to 75 days a year, contends that "future technology will increase the amount of 'homework.'" Indeed, many companies are already relaxing their insistence that work be done in the office. When Weyerhaeuser, the great timber-products company, needed a new brochure on employee conduct not long ago, Vice-President R. L. Siegel and three of his staff members met at his home for almost a week until they had hammered out a draft. "We felt we needed to get out [of the office], to avoid the distractions," says Siegel. "Working at home is consistent with our shift toward flexible hours," he adds. "The important thing is getting your job done. It's incidental to us where you do it."

According to the *Wall Street Journal*, Weyerhaeuser is not alone. "Many other companies also are letting their employees work at home," the newspaper reports, among them United Airlines, whose

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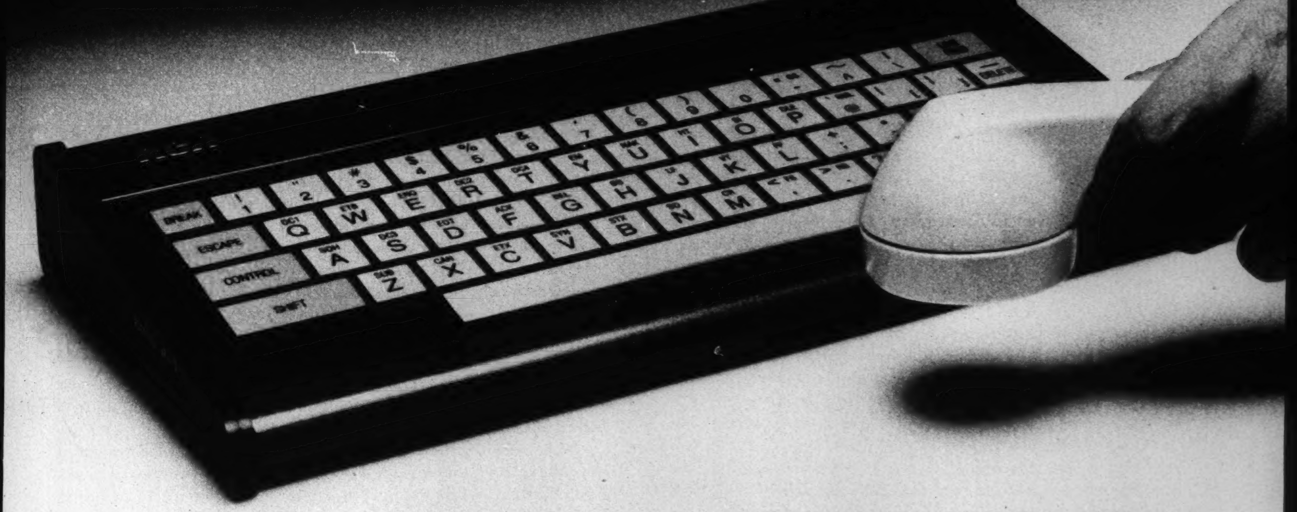

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Cottage, cont'd...

director of public relations allows his staff people to write at home as much as 20 days a year. Even McDonald's, whose lower-rung employees are needed to staff the hamburger grills, encourages home work among some top executives.

"Do you really need an office as such at all?" asks Booz Allen & Hamilton's Harvey Poppel. In an unpublished forecast, Poppel suggests that "by the 1990s, two-way communications capability [will have been] enhanced sufficiently to encourage a widespread practice of working at home." His view is supported by many other researchers, like Robert F. Latham, a long-range planner at Bell Canada in Montreal. According to Latham, "As information jobs proliferate and communications facilities improve, the number of people who may work at home or at local work centres will also increase."

Similarly, Hollis Vail, a management consultant for the United States Department of the Interior, asserts that by the mid-1980's "tomorrow's word-processing centers could easily be in one's own home"; he has written a scenario describing how a secretary, "Jane Adams," employed by the "Afgar Company" could work at home, meeting her boss only periodically to "talk over problems, and, of course, to attend office parties."

This same view is shared by the Institute for the Future, which, as early as 1971, surveyed 150 experts in "leading edge" companies dealing with the new information technologies, and spelled out five different categories of work that could be transferred to the home.

Given the necessary tools, the IFF found, many of the present duties of the secretary "could be done from home as well as in the office. Such a system would increase the labor pool by allowing married secretaries caring for small children at home to continue to work. . . . There may be no overriding reason why a secretary could not just as well, in many instances, take dictation at home and type the text on a home terminal which produces a clean text at the author's home or office."

In addition, IFF continued, "Many of the tasks performed by engineers, draftsmen, and other white-collar employees might be done from home as readily as, or sometimes more readily than, from the office." One "seed of the future" exists already in Britain, for example, where a company called F. International Ltd. (the "F" stands for Freelance) employs 400 part-time computer programmers, all but a handful of whom work in their own homes. The company, which organizes teams of programmers for industry, has expanded to Holland and Scandinavia and counts among its clients such giants as British Steel, Shell, and Unilever. "Home computer programming," writes the *Guardian* newspaper, is "the cottage industry of the 1980s."

In short, as the Third Wave sweeps across society, we find more and more companies that can be described, in the words of one researcher, as nothing but "people huddled around a computer." Put the computer in people's homes, and they no longer need to huddle. Third Wave white-collar work, like Third Wave manufacturing, will not require 100 percent of the work force to be concentrated in the workshop.

One should not underestimate the difficulties entailed in transferring work from its Second Wave locations in factory and office to its Third Wave location in the home. Problems of motivation and management, of corporate and social reorganization will make the shift both prolonged and, perhaps, painful. Nor can all communication be handled vicariously. Some jobs—especially those involving creative deal-making, where each decision is nonroutine—require much face-to-face contact. Thus Michael Koerner, President of Canada Overseas Investments, Ltd., says, "We all need to be within a thousand feet of one another."

THE TELECOMMUTERS

Nevertheless, powerful forces are converging to promote the electronic cottage. The most immediately apparent is the economic trade-off between transportation and telecommunication. Most high-technology nations are now experiencing a transportation crisis, with mass transit systems strained to the breaking point, roads and highways clogged, parking spaces rare, pollution a serious problem, strikes and breakdowns almost routine, and costs skyrocketing.

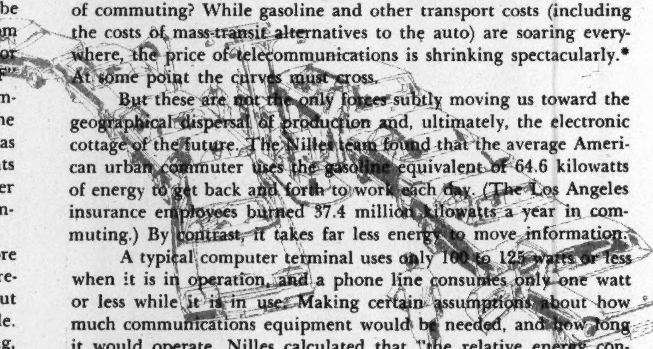
The escalating costs of commuting are borne by the individual workers. But they are, of course, indirectly passed on to the employer in the form of higher wage costs, and to the consumer in higher prices. Jack Nilles and a team sponsored by the National Science Foundation have worked out both the dollar and the energy savings that would flow from any substantial shift of white-collar jobs out of centralized downtown offices. Instead of assuming the jobs would go into the homes of employees, the Nilles group used what might be termed a halfway-house model, assuming only that jobs would be dispersed into neighborhood work centers closer to employee homes.

The implications of their findings are startling. Studying 2,048 insurance company employees in Los Angeles, the Nilles group found that each person, on average, traveled 21.4 miles a day to and from work (as against a national average of 18.8 miles for urban workers in the United States). The higher up the managerial scale, the longer the commute, with top executives averaging 38.2 miles. All told, these workers drove 12.4 million miles each year to get to work, using up nearly a half-century's worth of hours to do so.

At 1974 prices, this cost twenty-two cents per mile, or a total of $2,730,000—an amount borne indirectly by the company and its customers. Indeed, Nilles found that the company was paying its downtown workers $520 a year more than the going rate in the dispersed locations—in effect, "a subsidy of transportation costs." It was also providing parking spaces and other costly services made necessary by the centralized location. If we now assume a secretary was earning in the neighborhood of $10,000 a year, the elimination of this commuting cost could have permitted the company to hire nearly 300 additional employees or, alternatively, to add a substantial amount to profits.

The key question is: When will the cost of installing and operating telecommunications equipment fall below the present cost of commuting? While gasoline and other transport costs (including the costs of mass-transit alternatives to the auto) are soaring everywhere, the price of telecommunications is shrinking spectacularly.* At some point the curves must cross.

But these are not the only forces subtly moving us toward the geographical dispersal of production and, ultimately, the electronic cottage of the future. The Nilles team found that the average American urban commuter uses the gasoline equivalent of 64.6 kilowatts of energy to get back and forth to work each day. (The Los Angeles insurance employees burned 37.4 million kilowatts a year in commuting.) By contrast, it takes far less energy to move information.



A typical computer terminal uses only 100 to 125 watts or less when it is in operation, and a phone line consumes only one watt or less while it is in use. Making certain assumptions about how much communications equipment would be needed, and how long it would operate, Nilles calculated that "the relative energy consumption advantage of telecommuting over commuting (i.e., the ratio of commuting energy consumption to telecommuting consumption) is at least 29:1 when the private automobile is used; 11:1 when normally loaded mass transit is used; and 2:1 for 100 per cent utilized mass transit systems."

Carried to their conclusion, these calculations showed that in 1975, had even as little as 12 to 14 percent of urban commuting been replaced by telecommuting, the United States would have saved approximately 75 million barrels of gasoline—and would have thereby completely eliminated the need to import any gasoline from abroad. The implications of that one fact for the U.S. balance of payments and for Middle East politics might also have been more than trivial.

---

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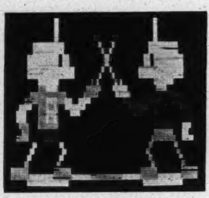

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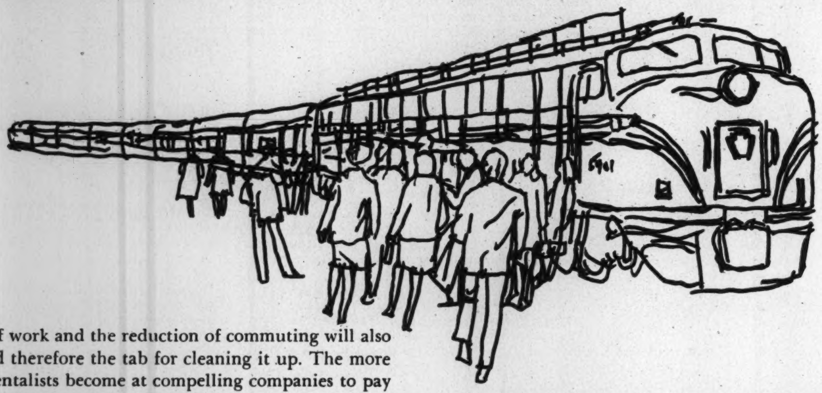
Cottage, cont'd...

As gasoline prices and energy costs in general rise in the decades immediately ahead, both the dollar cost and energy cost of operating "smart" typewriters, telecopiers, audio and video links, and home-size computer consoles will plummet, still further increasing the relative advantage of moving at least some production out of the large central workshops that dominated the Second Wave era.

All these mounting pressures toward telecommuting will intensify as intermittent gas shortages, odd-even days, long lines at the fuel pump, and perhaps rationing disrupt and delay normal commuting, further jacking up its cost in both social and economic terms.

To this we can add even more pressures tending in the same direction. Corporate and government employers will discover that shifting work into the home—or into local or neighborhood work centers as a halfway measure—can sharply reduce the huge amounts now spent for real estate. The smaller the central offices and manufacturing facilities become, the smaller the real estate bill, and the smaller the costs of heating, cooling, lighting, policing, and maintaining them. As land, commercial and industrial real estate, and the associated tax load all soar, the hope of reducing and/or externalizing these costs will favor the farming-out of work.



The transfer of work and the reduction of commuting will also reduce pollution and therefore the tab for cleaning it up. The more successful environmentalists become at compelling companies to pay for their own pollution, the more incentive there will be to shift to low-polluting activities, and therefore from large-scale, centralized workplaces to smaller work centers or, better yet, into the home.

Beyond this, as environmentalists and conservation-minded citizens groups battle against the destructive effects of the auto, and oppose road and highway construction, or succeed in banning cars from certain districts, they unwittingly support the transfer of work. The net effect of their efforts is to force up the already high cost and personal inconvenience of transport as against the low cost and convenience of communication.

When environmentalists discover the ecological disparities between these two alternatives, and as the shift of work to the home begins to look like a real option, they will throw their weight behind this important decentralist move and help coax us into the civilization of the Third Wave.

Social factors, too, support the move to the electronic cottage. The shorter the workday becomes, the longer the commuting time in relationship to it. The employee who hates to spend an hour getting to and from the job in order to spend eight hours working may very well refuse to invest the same commuting time if the hours spent on the job are cut. The higher the ratio of commuting time to working time, the more irrational, frustrating, and absurd the process of shuttling back and forth. As resistance to commuting rises, employers will indirectly have to increase the premium paid to workers in the big, centralized work locations, as against those willing to take less pay for less travel time, inconvenience, and cost. Once again there will be greater incentive to transfer work.

Finally, deep value changes are moving in the same direction. Quite apart from the growth of privatism and the new allure of small-city and rural life, we are witnessing a basic shift in attitude toward the family unit. The nuclear family, the standard, socially approved family form throughout the Second Wave period is clearly in crisis. We shall explore the family of the future in the next chapter. For now, we need only note that in the United States and Europe—wherever the transition out of the nuclear family is most advanced—there is a swelling demand for action to glue the family unit together again. And it is worth observing that one of the things that has bound families tightly together through history has been shared work.

Even today one suspects that divorce rates are lower among couples who work together. The electronic cottage raises once more on a mass scale the possibility of husbands and wives, and perhaps even children, working together as a unit. And when campaigners for family life discover the possibilities inherent in the transfer of work to the home we may well see a rising demand for political measures to speed up the process—tax incentives, for example, and new conceptions of workers' rights.

During the early days of the Second Wave era, the workers' movement fought for a "Ten Hour Day," a demand that would have been almost incomprehensible during the First Wave period. Soon we may see the rise of movements demanding that all work that *can* be done at home *be* done at home. Many workers will insist on that option as a right. And, to the degree that this relocation of work is seen as strengthening family life, their demand will receive strong support from people of many different political, religious, and cultural persuasions.

The fight for the electronic cottage is part of the larger super-struggle between the Second Wave past and the Third Wave future, and it is likely to bring together not merely technologists and corporations eager to exploit the new technical possibilities but a wide range of other forces—environmentalists, labor reformers of a new style, and a broad coalition of organizations, from conservative churches to radical feminists and mainstream political groups—in support of what may well be seen as a new, more satisfactory future for the family. The electronic cottage may thus emerge as a key rallying point of the Third Wave forces of tomorrow.

THE HOME-CENTERED SOCIETY

If the electronic cottage were to spread, a chain of consequences of great importance would flow through society. Many of these consequences would please the most ardent environmentalist or techno-rebel, while at the same time opening new options for business entrepreneurship.

Community Impact: Work at home involving any sizeable fraction of the population could mean greater community stability—a goal that now seems beyond our reach in many high-change regions. If employees can perform some or all of their work tasks at home, they do not have to move every time they change jobs, as many are compelled to do today. They can simply plug into a different computer.

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Cottage, cont'd...

This implies less forced mobility, less stress on the individual, fewer transient human relationships, and greater participation in community life. Today when a family moves into a community, suspecting that it will be moving out again in a year or two, its members are markedly reluctant to join neighborhood organizations, to make deep friendships, to engage in local politics, and to commit themselves to community life generally. The electronic cottage could help restore a sense of community belonging, and touch off a renaissance among voluntary organizations like churches, women's groups, lodges, clubs, athletic and youth organizations. The electronic cottage could mean more of what sociologists, with their love of German jargon, call *gemeinschaft*.

Environmental Impact: The transfer of work, or any part of it, into the home could not only reduce energy requirements, as suggested above, but could also lead to energy decentralization. Instead of requiring highly concentrated amounts of energy in a few high-rise offices or sprawling factory complexes, and therefore requiring highly centralized energy generation, the electronic cottage system would spread out energy demand and thus make it easier to use solar, wind, and other alternative energy technologies. Small-scale energy generation units in each home could substitute for at least some of the centralized energy now required. This implies a decline in pollution as well, for two reasons: first, the switch to renewable energy sources on a small-scale basis eliminates the need for high-polluting fuels, and second, it means smaller releases of highly concentrated pollutants that overload the environment at a few critical locations.

Economic Impact: Some businesses would shrink in such a system, and others proliferate or grow. Clearly, the electronics and computer and communications industries would flourish. By contrast, the oil companies, the auto industry, and commercial real estate developers would be hurt. A whole new group of small-scale computer stores and information services would spring up; the postal service, by contrast, would shrink. Papermakers would do less well; most service industries and white-collar industries would benefit.

At a deeper level, if individuals came to own their own electronic terminals and equipment, purchased perhaps on credit, they would become, in effect, independent entrepreneurs rather than classical employees—meaning, as it were, increased ownership of the "means of production" by the worker. We might also see groups of home-workers organize themselves into small companies to contract for their services or, for that matter, unite in cooperatives that jointly own the machines. All sorts of new relationships and organizational forms become possible.

Psychological Impact: The picture of a work world that is increasingly dependent upon abstract symbols conjures up an over-cerebral work environment that is alien to us and, at one level, more impersonal than at present. But at a different level, work at home suggests a deepening of face-to-face and emotional relationships in both the home and the neighborhood. Rather than a world of purely vicarious human relationships, with an electric screen interposed between the individual and the rest of humanity, as imagined in many science fiction stories, one can postulate a world divided into two sets of human relationships—one real, the other vicarious—with different rules and roles in each.

No doubt we will experiment with many variations and halfway measures. Many people will work at home part-time and outside the home as well. Dispersed work centers will no doubt proliferate. Some people will work at home for months or years, then switch to an outside job, and then perhaps switch back again. Patterns of leadership and management will have to change. Small firms would undoubtedly spring up to contract for white-collar tasks from larger firms and take on specialized responsibilities for organizing, training, and managing teams of homeworkers. To maintain adequate liaison among them, perhaps such small companies will organize parties, social occasions, and other joint holidays, so that the members of a team get to know one another face-to-face, not merely through the console or keyboard.

Certainly not everyone can or will (or will want to) work at home. Certainly we face a conflict over pay scales and opportunity cost. What happens to the society when an increased amount of human interaction on the job is vicarious while face-to-face, emotion-to-emotion interaction intensifies in the home? What about cities? What happens to the unemployment figures? What, in fact, do we mean by the terms "employment" and "unemployment" in such a system? It would be naïve to dismiss such questions and problems.

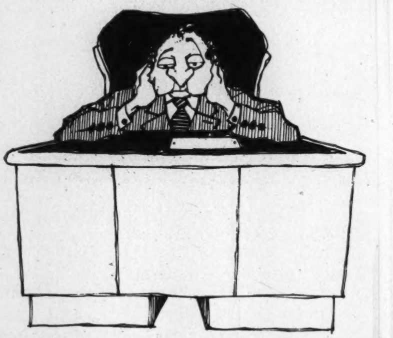
But if there are unanswered questions and possibly painful difficulties, there are also new possibilities. The leap to a new system of production is likely to render irrelevant many of the most intractable problems of the passing era. The misery of feudal toil, for example, could not be alleviated within the system of feudal agriculture. It was not eliminated by peasant revolts, by altruistic nobles, or by religious utopians. Toil remained miserable until it was altered entirely by the arrival of the factory system, with its own strikingly different drawbacks.

In turn, the characteristic problems of industrial society—from unemployment to grinding monotony on the job, to overspecialization, to the callous treatment of the individual, to low wages—may, despite the best intentions and promises of job enlargers, trade unions, benign employers, or revolutionary workers' parties, be wholly unresolvable within the framework of the Second Wave production system. If such problems have remained for 300 years, under both capitalist and socialist arrangements, there is cause to think they may be inherent in the mode of production.

The leap to a new production system in both manufacturing and the white-collar sector, and the possible breakthrough to the electronic cottage, promise to change all the existing terms of debate, making obsolete most of the issues over which men and women today argue, struggle, and sometimes die.

We cannot today know if, in fact, the electronic cottage will become the norm of the future. Nevertheless, it is worth recognizing that if as few as 10 to 20 percent of the work force as presently defined were to make this historic transfer over the next 20 to 30 years, our entire economy, our cities, our ecology, our family structure, our values, and even our politics would be altered almost beyond our recognition.

It is a possibility—a plausibility, perhaps—to be pondered.



It is now possible to see in relationship to one another a number of Third Wave changes usually examined in isolation. We see a transformation of our energy system and our energy base into a new *techno-sphere*. This is occurring at the same time that we are de-massifying the mass media and building an intelligent environment, thus revolutionizing the *info-sphere* as well. In turn, these two giant currents flow together to change the deep structure of our production system, altering the nature of work in factory and office and, ultimately, carrying us toward the transfer of work back into the home.

By themselves, such massive historical shifts would easily justify the claim that we are on the edge of a new civilization. But we are simultaneously restructuring our social life as well, from our family ties and friendships to our schools and corporations. We are about to create, alongside the Third Wave techno-sphere and info-sphere, a Third Wave *socio-sphere* as well. ☐

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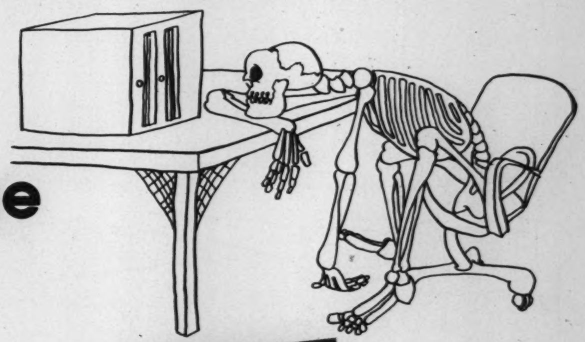

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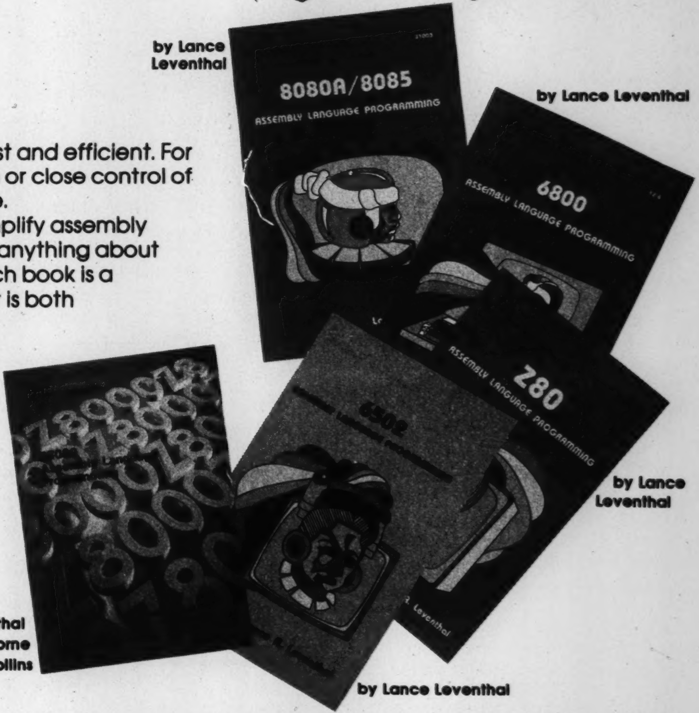
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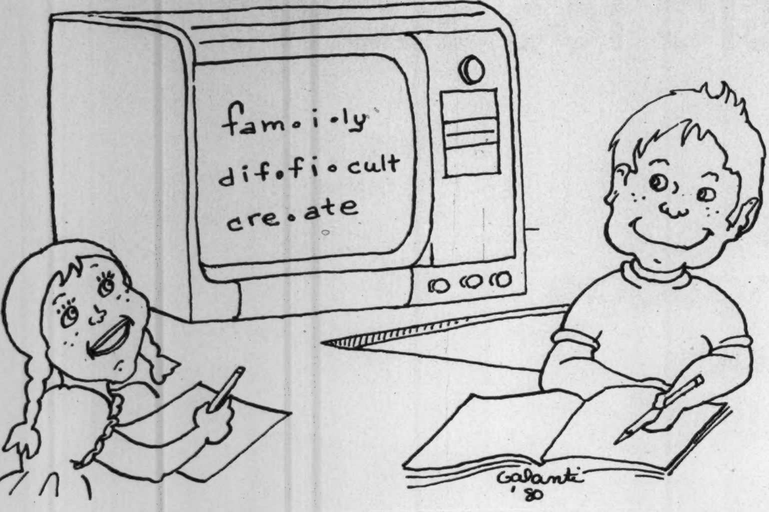

Do Computers Byte?

Judy Neyhart

"Bytes — shmytes!" I said, "Computers may be the *in* thing, but what will having one in my home do for me?" That was my response when my husband and son suggested that we just *had* to have a personal computer. We bought one despite my objections. But now, our Apple, Mac, (it seemed logical to name him Mac since we live in Macintosh country) has become a trusted and much appreciated member of our family. To me a computer was only useful for fouling up the information in my charge account or making mistakes in my bank account, but now I've found that as a mother and homemaker, there are many uses that are valuable to me.

This realization did not come easily. I had a mental block about computers as does, I believe, the average non-data processing adult. My eight-year-old son eagerly read all the manuals and soon learned to program, but I was always "too busy."

My husband demonstrated Mac at a charity computer fair. I sat in the background and watched the many people "playing" delightedly with the keyboard, watching the brightly-colored images on the large TV screen, and listening to the distinctly tuneful computer music. I wondered what I might be missing. Is this box in my house really something I can use?

After months of ignoring Mac, I got some quick tips from my husband on loading the disks and listing the programs. He was so ecstatic that I was at last beginning to share his enthusiasm. Then I began to learn at my own speed. The mental wall was beginning to fall. I'd sit down during the day and practice when no one was watching.

At the National Computer Conference in New York City came the final turning point. I saw the vast and exciting possibilities that lie ahead in the computer field — control of home appliances, color printing, even robots. We bought a printer there, making it possible to display on paper the words and graphics on the screen. With the expanded uses of the printer, my conversion to happy computer owner was complete.

To all the wives and mothers sympathizing with my computer apathy, I hope you'll give a home computer a chance. I'll list the advantages I now see and the uses I now make of *my* Apple.

1. My checkbook balancing was always a challenge. When the monthly statement came, I'd dread the battle of the numbers. Now with Mac's help — it's easy. Each Monday as I pay bills, I enter the checks and he does the balancing. As an added bonus, he also sorts according to category (household, entertainment, insurance, etc.). When the statement comes, I just enter the checks that have been cleared through the bank and he does the rest. The numbers are a snap because, as you know, "Computers don't make misteaks (sic)."

At the National Computer Conference I saw the vast and exciting possibilities that lie ahead in the computer field.

2. My children are in the elementary grades and with the Back-to-Basics movement, arithmetic (the old type) is again in vogue. Mac is an excellent unbiased drill sergeant. He can display addition, subtraction, or multiplication problems, do the problem-solving timing, and even grade the results. Along with that he gives praise when earned — "Very Good," "You're Getting Better," or "Try Again." One session a day, and they're both tops in their class.

3. Spelling is also done the same way. When they bring home the list of "Words to study at home," Mommy enters the words in the Spelling Program. Then Mac does the teaching and I'm free to do the wash.

4. As a PTA member, I use Mac and the printer to make Room Mother lists of the students in the class and their phone numbers. I can see that when the news of Mac's capability gets out, I will be a valuable member in other nonprofit groups for keeping member lists.

5. Every week during the fall, we have a family football pool. I enter my choices of college and pro games for the week and make a printout for each of us. We read the predictions and past scores and circle our choices. After the games of the weekend are over, I print out the results of games won, lost, and percentages. We all enjoy this as a family activity and Mac makes it easy.

6. With a supplemental speaker Mac makes a very acceptable organ/music box. The children have learned much about reading music in the conversion of sheet music to computer music (notes, duration, voice). There's a great deal of satisfaction in typing in the proper collection of numbers and letters and getting a very recognizable tune as the result.

7. My address card file box is now obsolete. Mac can not only keep all my friends' names and addresses, but also alphabetize them and print out mailing labels. My Christmas cards are very original and the graphics potential in designs for them is limited only by my imagination. I can make designs by plotting points on the screen or using the etch-a-sketch program. There are also elaborate programmed designs available.

8. The homemaker can sometimes get lost in the humdrum of washing, ironing and cooking. There's not much in our day-

Judy Neyhart, R.D. 5, Box 66D, Kingston, NY 12401.

to-day life that can be stimulating to our mental processes. Mac acts as the stimulation for my brain power through logic games such as Othello, Mastermind, and chess. Through Mac I know my homemaker/mother brain will never decay from lack of use.

9. The word processor programs are very useful in arranging and copying informative family letters. The busy days of tending to a growing family's needs do not leave much free time to keep the nonlocal family members (aunts, grandmothers) informed on our activities and happenings. Mac gives me the capability to write one newsy letter and copy it for all family members from Timbuktu to Outer Mongolia. I write short notes on the bottom of each for that personalized touch. The price of a letter really does beat the charges of Ma Bell.

10. My latest project is a family tree program to trace our family's roots. Mac can store and organize the ancestor name and vital information — dates and locations of birth, marriage, and death — and keep the generations in order.

My Apple and I are great friends. I realize that I am very fortunate to be able to "get in on the ground floor" of the personal computer explosion. I don't know what lies ahead in the computer field, but whatever it is, I'm going to be right in step with the progress along the way. ☐

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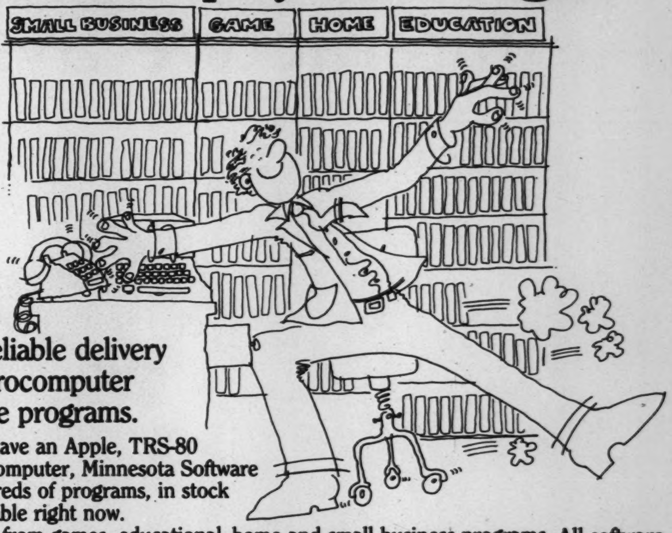

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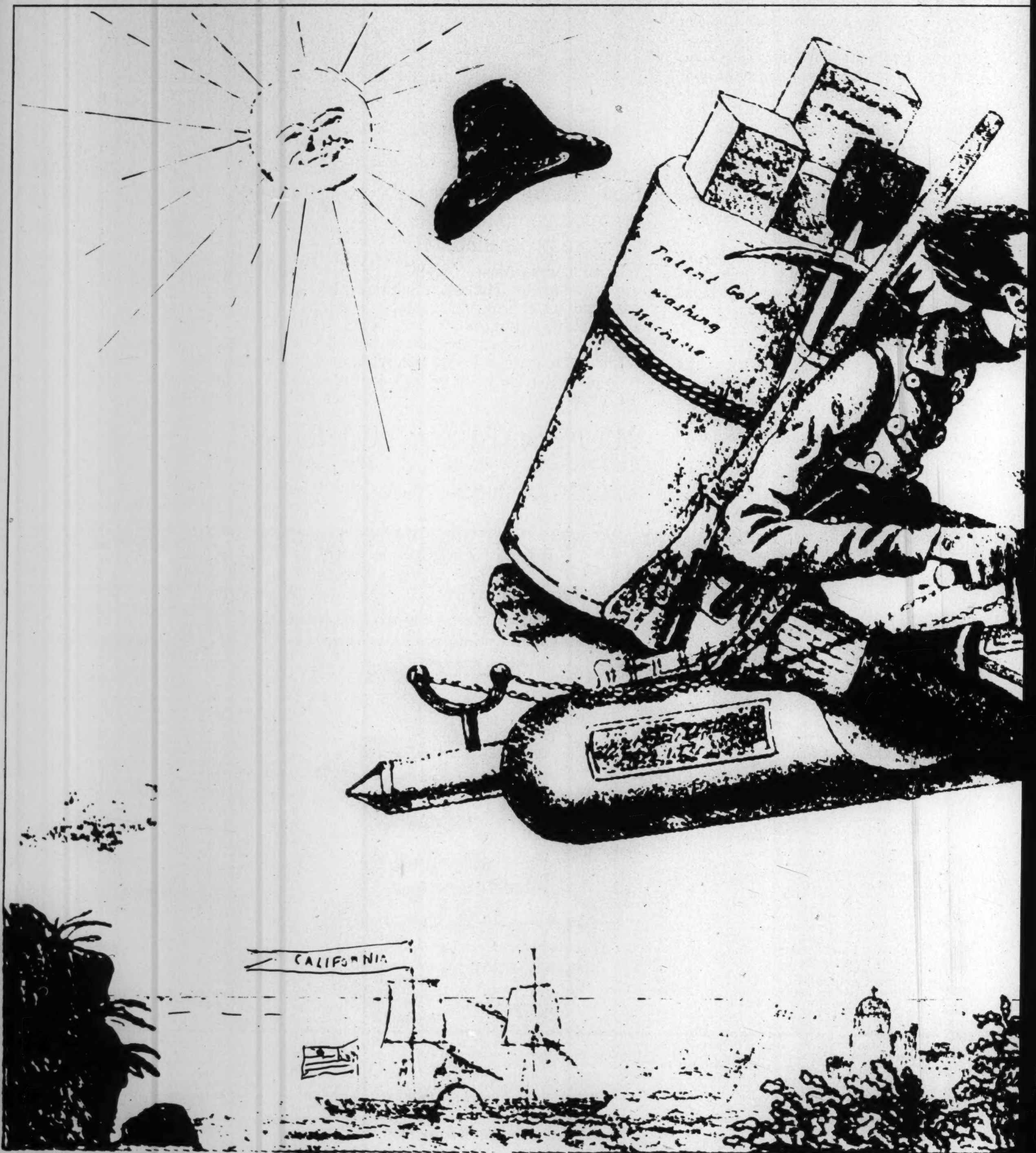
CIRCLE 145 ON READER SERVICE CARD

Interactive Systems and the


Patent Gold washing Machine
CALIFORNIA

Design of Virtuality Part Two

Ted Nelson

In Part I, we considered some nice examples of highly responsive systems. The reality of their implementation details is comparatively unimportant. What *is* important is the design of the conceptual structure and feel of a system; we call this its "virtuality" as distinct from the (unimportant) reality.

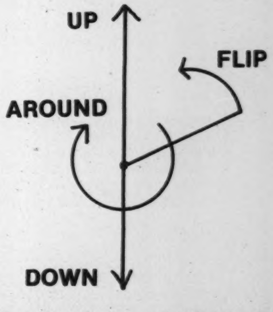
In this concluding section we consider some more design examples, and endeavor to find the right principles on which to base the design of interactive systems in general.

A COMPLETE SYSTEM

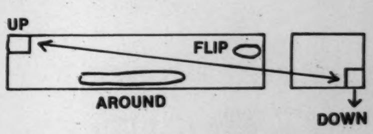
In one design, the Funny-Face Softree™system, I have endeavored to show that one simple, overarching control structure can be used for a *complete* personal computer system—including word processor, scheduling system, graphics package, bookkeeping package, typesetting and layout programs, etc. (I do not wish to imply, of course, that this is the only way to organize such an integrated system; merely that this one interests me.)

There are four basic controls. These are the *only* controls. They may be understood quickly in a brief demonstration, but in fact the further ramifications of their interaction may become clear gradually.

The controls we call *up, down, around* and *flip.*



I would marry these to the Radio Shack keyboard as follows:



Up and *down* are the easiest. The user

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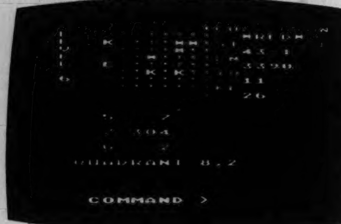
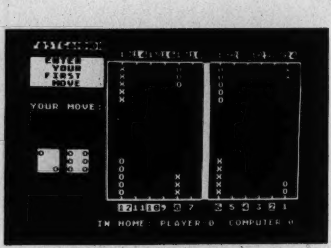
SOFTWARE FOR THE ATARI* 800
AND THE ATARI 400



TARI TREK™
By Fabio Ehrengruber

Get ready for an exciting trek through space. Your mission is to rid the galaxy of Klingon warships, and to accomplish this you must use strategy to guide the starship Enterprise around stars, through space storms, and amidst enemy fire. Sound and color enliven this action-packed version of the traditional trek game. Nine levels of play allow the player to make the mission as easy or as challenging as he wishes. At the highest level you are also playing against time. Damage to your ship can be repaired in space at a cost of time and resources if you can't make it back to base. TARI TREK gives you a lot of trek at a low price. This program is written entirely in BASIC and requires at least 24K of user memory. For the Atari 800 only.

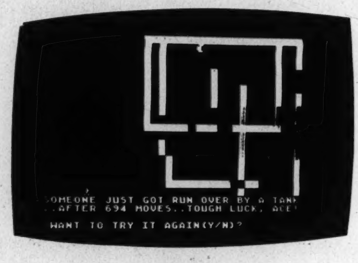
Cassette - $11.95 Diskette - $14.95



FASTGAMMON™
By Bob Christiansen

Play backgammon against a talented computer opponent. This is the latest and best version of the most popular backgammon-playing program for personal computers - FASTGAMMON. Roll your own dice or let the computer roll them for you. Adjust the display speed to be fast or slow. If you wish you can play a game using the same dice rolls as the previous game - a great aid in improving your skills at backgammon. Beginners find it easy to learn backgammon by playing against the computer, and even very good players find it a challenge to beat FASTGAMMON. The 12-page instruction booklet includes the rules of the game. Written in machine language. Requires only 8K of RAM and runs on both the Atari 400 and the Atari 800.

On cassette only - $19.95



```
SOMEONE JUST GOT RUN OVER BY A TANK
..AFTER 694 MOVES..TOUGH LUCK, ACE!

WANT TO TRY IT AGAIN(Y/N)?
```

TANK TRAP
By Don Ursem

A rampaging tank tries to run you down. You are a combat engineer, building concrete barriers in an effort to contain the tank. Use either the keyboard or an Atari joystick to move your man and build walls. If you trap the tank you will be awarded a rank based on the amount of time and concrete you used up. But they'll be playing taps for you if you get run over. There are four levels of play. Higher levels of play introduce slow curing concrete, citizens to protect, and the ability of the tank to shoot through any wall unless you stay close by. Music, color, and sound effects add to the excitement. Written in BASIC with machine language subroutines. Requires at least 16K of user memory. Runs on the Atari 800 and on an Atari 400 with 16K RAM.

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QS FORTH™ By James Albanese. Step into the world of the remarkable FORTH programming language. Writing programs in FORTH is much easier than writing them in assembly language, yet FORTH programs run almost as fast as machine code and many times faster than BASIC programs. QS FORTH is based on fig-FORTH, the popular model from the FORTH Interest Group that has become a standard for microcomputers. QS FORTH is a disk-based system that can be used with up to four disk drives. There are five modules included:

1. The FORTH KERNEL (The standard fig-FORTH model customized to run on the Atari computer).
2. An EXTENSION to the basic vocabulary that contains some handy additional words.
3. An EDITOR that allows editing source programs (screens) using Atari type editing.
4. An IOCB module that makes I/O operations easy to set up.
5. An ASSEMBLER that allows defining FORTH words as a series of 6502 assembly language instructions.

Modules 2-5 may not have to be loaded with the user's application program, allowing for some efficiencies in program overhead. Full error statements (not just numerical codes) are printed out, including most disk error statements. QS FORTH requires at least 24K of RAM and at least one disk drive. For the Atari 800 only.

On diskette only - $79.95

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

ASSEMBLER by Gary Shannon. Write your own 6502 machine language programs with this inexpensive in-RAM editor/assembler. Use the editor to create and edit your assembler source code. Then use the assembler to translate the source code into machine language instructions and store the code in memory. Simple commands allow you to save and load the source code to and from cassette tape. You can also save any part of memory on tape and load it back into RAM at the same or at a different location. The assembler handles all 6502 mnemonics plus 12 pseudo-ops that include video and printer control. Commenting is allowed and error checking is performed. A very useful feature allows you to view and modify hexadecimal code anywhere in memory. Instructions on how to interface machine language subroutines to your BASIC programs are included. ASSEMBLER requires 16K of user memory and runs on both the Atari 800 and the Atari 400.

On cassette only - $24.95

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

6502 DISASSEMBLER by Bob Pierce. This neat 8K BASIC program allows you to disassemble machine code, translating it and listing it in assembly language format on the video and on the printer if you have one. 6502 DISASSEMBLER can be used to disassemble the operating system ROM, the BASIC cartridge, and machine language programs located anywhere in RAM except where the DISASSEMBLER itself resides. (Most Atari cartridges are protected and cannot be disassembled using this disassembler.) Also works as an ASCII interpreter, translating machine code into ASCII characters. 6502 DISASSEMBLER requires only 8K of user memory and runs on both the Atari 800 and the Atari 400.

Cassette - $11.95 Diskette - $14.95

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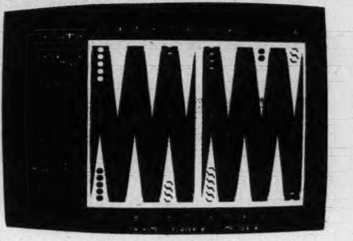
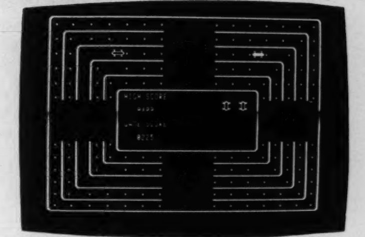
CIRCLE 231 ON READER SERVICE CARD

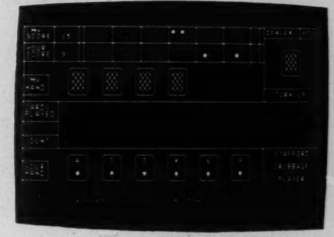
SOFTWARE FOR THE SORCERER*



FASTGAMMON



HEAD-ON COLLISION



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UTILITY PROGRAMS

FORTH. Now Sorcerer owners can enjoy the convenience and speed of the fascinating FORTH programming language. Based on fig-FORTH and adapted for the Sorcerer by James Albanese, this version uses simulated disk memory in RAM and does not require a disk drive. Added to standard fig-FORTH are an on-screen editor, a serial RS-232 driver, and tape save and load capability. Eight-bit input/output has been added allowing use of the Sorcerer's graphics keys Documentation includes examples. Requires 32K or more of RAM. **$49.95**

new! BEDIT by Ernest Bergmann. A BASIC editor. This short and easy to use program is a machine language routine that loads in low memory and allows you to edit your BASIC programs by modifying text on the video screen. No more retyping a long line just to change one character. A few cursor movements make the necessary modifications. Even renumbering lines is easy to do. This program is a real timesaver. Runs on any size Sorcerer. **$11.95**

new! GRAPHICS ANIMATION by Lee Anders. This package provides the BASIC programmer with a powerful set of commands for graphics and animation. The program is written in machine language but is loaded together with your BASIC program and graphics definitions with a CLOAD command. Any image from a character to a large graphic shape may be plotted, moved, or erased with simple BASIC commands. Encounters of plotted character sets with background characters are detected and background images are preserved. Contains a medium resolution plotting routine. A keyboard routine detects key presses without carriage returns. Includes a separate program for constructing images. Runs on any size Sorcerer. **$29.95**

QS SMART TERMINAL by Bob Pierce. Convert your Sorcerer to a smart terminal. Used with a modem, this program provides the capability for you to communicate efficiently and save connect time with larger computers and other microcomputers. The program formats incoming data from time-sharing systems such as The Source for the Sorcerer video. Incoming data can be stored (downloaded) into a file in RAM. Files, including programs, may be saved to or loaded from cassette, listed on the video, transmitted out through your modem, or edited with an on-board text editor. Interfaces with BASIC and the Word Processor Pac. **$49.95**

DPX™ (Development Pac Extension) by Don Ursem. Serious Z80 program developers will find this utility program to be invaluable. Move the line pointer upward. Locate a word or symbol. Change a character string wherever it occurs. Simple commands allow you to jump directly from EDIT to MONITOR or DDT80 modes and automatically set up the I/O you want for listings. Built-in serial driver. Stop and restart listings. Abort assembly with the ESC key. Save backup files on tape at 1200 baud. Load and merge files from tape by file name. Versions for 8K, 16K, 32K, and 48K Sorcerer all on one cassette. Requires the Sorcerer's Development Pac. **$29.95**

PLOT by Vic Tolomei. Now Apple owners will be envious of how easy you can get good graphics on your SORCERER. PLOT includes both a super high resolution mode and a quick low resolution mode. Both are accessible from your BASIC programs using simple commands. Hi-res & lo-res examples included on tape. **$14.95**

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SOFTWARE INTERNALS MANUAL FOR THE SORCERER by Vic Tolomei. A must for anyone writing software for the SORCERER. Seven chapters: Intro to Machine Language, Devices & Ports, The Monitor, Cassette Interface, BASIC structure, Video & Graphics, The Keyboard. Indexed. Includes diagrams and software routines. 64 pages. **$14.95**

SIMULATIONS AND GAMES

new! CRIBBAGE by Bob Stafford. The computer challenges you to a game of cribbage. An excellent use of graphics displays the cribbage board and all the playing cards. The computer pegs the score, computes all the counts, and plays the good game, adhering strictly to the rules of standard cribbage. Beginners will find it easy to learn the game by playing against the computer, and experienced players will enjoy trying to outsmart the computer with crib layaways and careful play. Requires at least 16K of memory. **$17.95**

STARBASE HYPERION™ by Don Ursem. At last, a true strategic space game for the Sorcerer! Defend a front-line Star Fortress against invasion forces of an alien empire. You create, deploy, and command entire ship squadrons as well as ground defenses in this complex tactical simulation of war in the far future. Written in BASIC and Z-80 code. Full graphics and realtime combat status display. Includes full instructions and STARCOM battle manual. Requires at least 16K of RAM. **$17.95**

HEAD-ON COLLISION™ by Lee Anders. You are driving clockwise and a computer-controlled car is driving counter clockwise. The computer's car is trying to hit you head on, but you can avoid a collision by changing lanes and adjusting your speed. At the same time you try to drive over dots and diamonds to score points. Three levels of play, machine language programming, and excellent graphics make this game challenging and exciting for all. At least 16K of RAM is required. **$14.95**

LUNAR MISSION by Lee Anders. Land your spacecraft softly on the moon by controlling your craft's three propulsion engines. Avoid lunar craters and use your limited fuel sparingly. You can see both a profile view of the spacecraft coming down and a plan view of the landing area. Land successfully and you get to view an animated walk on the moon. Nine levels of play provide a stiff challenge to the most skillful astronaut. Requires at least 16K of RAM. **$14.95**

new! HANGMAN/MASTERMIND by Charles Finch. Two traditional games are brought to life by Sorcerer graphics. HANGMAN has three different vocabulary levels for you to choose from. In MASTERMIND, the computer selects a four-character code and you have to uncover it. These two games provide an enjoyable way for young people to develop their vocabulary and their logical reasoning ability. Written in BASIC, for any size Sorcerer. **$11.95**

FASTGAMMON™ by Bob Christiansen. Backgammon players love this machine language program that provides a fast, skillful opponent. Option to replay a game with the same dice rolls. Eight-page instruction manual includes rules of backgammon. **$19.95**

MARTIAN INVADERS™ by James Albanese. How long can you hold out against a persistent invasion force from Mars? Zap all the members of the landing party and another group comes after you. The longer you hold out, the higher your score. The Sorcerer's programmable graphics make this game look great, plus we've added special keyboard routines to really zip it up. Written in machine language. **$14.95**

NIKE II™ by Charles Finch and Bob Broffel. You may never get your computer back from your kids once they start playing Nike II. The object is to destroy enemy bombers by firing Nike missiles at them. If you miss the bombers, they bomb your factories and return for a second pass. Nine levels of play make this game a challenge for everyone. Written in machine language. **$11.95**

TANK TRAP by Don Ursem. An action game that combines skill, strategy, and luck. A rampaging tank tries to run you down. You are a combat engineer, building concrete barriers in an effort to contain the tank. Four levels of play make this animated game fun for everyone. Written in BASIC with machine language subroutines. **$11.95**

MAGIC MAZE™ by Vic Tolomei. A challenging maze game. Ten levels of play. Holding your lantern, you wander through a maze trying to stay on the right path and avoid pitfalls. Automatic scoring tells you how good a pathfinder you are. **$11.95**

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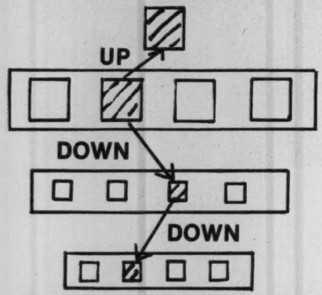
*The name "SORCERER" has been trademarked by Exidy, Inc.

CIRCLE 243 ON READER SERVICE CARD

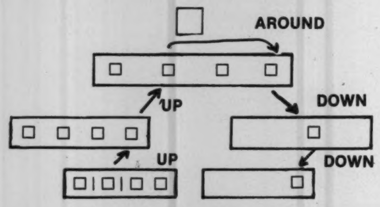
Virtuality, cont'd...

is at all times on a tree of functions. Each node is a particular activity or way-station on the tree. *Up* of course takes you to the node above you on the tree. And on this tree, *down* is always specified at any given moment as one of the specific alternatives below.

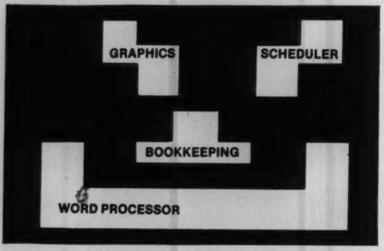


We may call this a *latching tree*. From your current node you may go down or up. If you go up, you get to the top; if you go down, you follow the path of already latched, or chosen, selections.

How do you change the selection of the node which is *down*? You do this by pressing *around*, which selects in turn each of the different alternatives below. (I call such a circular succession of choices a *ringstep*.) Thus to go between any two places on the tree only a few particular steps are required: something like *up*, *up*, *around*, *down*, *down*.



How do you see where you are and make the choices? Now comes the really unusual part. Each menu is a *jack-o-lantern face*.

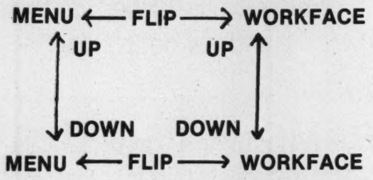


You go up and down a tree of menus. Each face has one of its features (left or right eye, nose or mouth) *flashing slightly*. This is the current selection below.

Now a frequent complaint about menus is that you have to take time to read them. In this system that is only true at first; because *every menu has a different facial expression*. So that as you become familiar with the different menus, their scowls and grins tell you where you are at once, and you can make your choices faster and faster.

At the very bottom level of the tree are particular activities; *down* there commands the events themselves.

There are also working faces, however, corresponding to every menu, on which materials may be viewed, scrolled, etc. This working face is the "other side" of the menu. You get to the workface, or back to its menu, by *flip*.



That's essentially all there is to it. What you have seen is what the beginner sees. I have left out showing how the different parts combine, so that, for example, the graphics tablet used with the scheduler produces animation, or the scheduler used with the word processor permits a magazine layout.

I would point out certain other features, however. One is that there are very few steps between paired activities, and the user going repeatedly back and forth between them gets into a rhythm. Faster methods would be in reality less simple.

Another aspect is the system's uniformity of replicative structure. You can go anywhere with confidence that the structure will hold. (It does become quite irregular, however, at the bottom or execution level.)

Some people tell me they'd rather have an input-string command language. That's a mater of taste. Other critics say this system lacks generality, which misses the point. It is simple, easy to learn, and integrated. You cannot get lost. And the funny faces are good for a laugh.

THE XANADU™ HYPERTEXT ENVIRONMENT

The Xanadu™ hypertext system, toward which I and colleagues have worked for some twenty years now, is intended as a super document library and annotation system, among other things. We may also think of it as a new form of storage and publication.

The Xanadu system is planned as a network of storage computers in McDonald's-like franchised stands around the country. By dialing into your local Xanadu stand, you may get anything on the whole network—to which your local stand is tied by high-speed lines. You must access the system from a fairly powerful terminal—that is, a computer, for reasons which will become clear later.

While most of the Xanadu work has gone into problems of its implementation—especially algorithmic design and analysis—the system's emerging virtuality has acquired an extremely interesting character, which I will now describe.

Everything stored in the Xanadu system we call a *document*. A piece of text, a picture, a movie (someday), a lonesome marginal note—each of these is a document.

Any document you want comes when you ask for it, if you are entitled to it. A document is private or public—that is, published. Any user may call up any public document instantly, as well as his own private documents or any other private documents he has permission to use.

LINKS AND WINDOWS

Links may be put anywhere in any document. Links, like footnotes or marginal comments, permit a user to jump to related material at any time—and come back from that other material when he likes.

Free-form, non-sequential writing of any kind—what we call collectively "hypertext"—is made possible by these links. But the virtuality of general hypertext would take a book in itself.

An important type of link is the window. A window may be thought of as a "hole" in one document through which shows a part of another document.

CHANGES AND VERSIONS

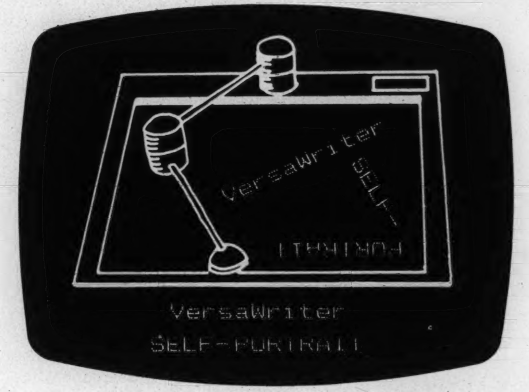
Not only may an author store a document in its present form; he may, if he chooses, write or rework the document on the system, with the changes themselves stored. The Xanadu system does this at a uniquely low incremental cost, since our data structure and algorithms essentially assemble parts of a given version as they are needed—without ever bothering to assemble the full consecutive structure, unless it is asked for.

Thus the user has access, if the materials are saved and open to him, to a reconstruction of any previous version of a document at any previous moment he cares to specify.

Not merely consecutive historical changes, but alternative versions, may be generated at any time. Thus a document may be "rewritten" for different types of readers, and these different versions stored at low overhead.

The user may ask to see any given piece of text (or other information) in any version or at any previous time.

PRICE BREAKTHROUGH



We have used the VersaWriter to draw a picture of itself. Text may be added in any size or direction.

VersaWriter

High-Resolution Color Graphics for Apple II or Apple II Plus

The VersaWriter graphics tablet lets you create multicolor graphics and drawings with your Apple computer. It compares in quality to graphic bit pads and digitizers costing three times more money.

VersaWriter is a digitizer and software package which presents a new approach to hi-res graphics. It consists of a mylar plotting board with a clear plastic overlay. Attached to this board is the drawing arm, which has a magnifying lens with a crosshairs at its end. You simply place any graph, picture or drawing (up to 8½" x 11") under the plastic overlay and "trace" it with the drawing arm. As you trace the drawing appears on the video screen.

The superior software of the VeraWriter enables you to do much more than just trace. Immediate commands include: color choice, brush size (the width of the drawing line), fill figure with color, draw a straight line between two points, use a different scale for drawing (.25 to 4), edit, erase, smothing factor (rounds off the rough edges as you draw), store picture on disk, and more.

One exceptional feature of the VersaWriter is the Shape Table function. You can take any picture, or portion of a picture, and store it as a shape table. Then the table can be recalled from memory and placed on any part of the screen. You can change the size of the image, rotate it, add to it, etc. By incorporating a series of images into a single shape table, commonly used symbols can be easily inserted into a variety of different programs. VersaWriter software includes an Electronic Drawing program which is a shape table of common schematic symbols-this program will give you a good idea of what the shape table can do, as well as let you easily produce electronic or logic diagrams.

Other programs included in the software are: the Textwriter, with which text can be added to graphics (UPPER & lower case, choice of color, text size, direction of text, starting point of text). Area/Distance-this program allows you to calculate distances (or perimeters) by establishing a measuring unit (of your choice) and tracing the shape or map route with the drawing arm. Areas of figures are calculated in the same way-this includes irregular and open figures. A very simple calibration program is also on this software disk.

A second software disk contains VersaWriter demonstration programs. For more advanced use of high-res graphics, there is a skeleton program which contains the guts of the VersaWriter. The VersaWriter is a sturdy peripheral device which plugs into the game paddles I/O port-the VersaWriter does not use up a card slot in the Apple computer. Also, the VersaWriter is not subject to the grounding problems and strong magnetic field problems of other, more expensive, hi-res graphic devices.

VersaWriter requires an Apple II with Applesoft in ROM (or an Apple II Plus), Disk, and a least 32K of memory.

VersaWriter comes complete with 8½" x 11" drawing surface, plastic overlay and two disks of software. Price $252.00 postpaid in continental USA. VersaWriter has a 90-day warranty on parts and labor.

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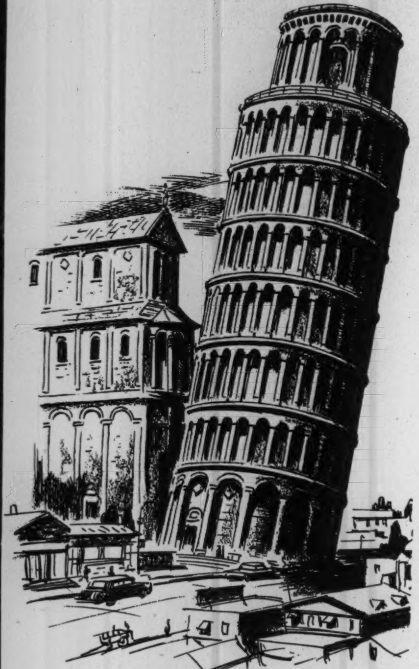
Virtuality, cont'd...



A link made to a certain part of one version of a document may be automatically followed through to the same material in any other version of that document or in its previous incarnations or in other public documents that windows it.

We believe that this "versioning" facility, of linkage across backtrack and alternative versions, solves a central problem of text systems — that of cross-referencing any parts still being worked on; a problem which is chopped at and nibbled at everywhere but is often dealt with in ineffectual ways.

FREE LINKING BY ANYBODY

You may create a document that links to any other documents, if they are public (he who publishes must agree to this in advance).

You may create, in your document, windows to anybody else's public documents. (Since they get the royalty when their part shows, they should be pleased.)

This is how we handle marginal notes. If you create a marginal note, it is automatically put in a new companion document, your document, which is permanently linked to the document you have annotated.

(This "companion document" idea also frees you to *alter and rewrite any public document any way you like*—since the alteration is in a private file of your own that points to the intact original.)

COPYRIGHT

"What of the copyright problem?" you ask. Our solution is simple: as you use the system, you are continuously paying small increments of royalties to copyright owners. These are modest amounts, the same for all users: for instance, if we can supply the service for two dollars an hour at 30 characters per second, the fixed royalty runoff will probably be about five cents an hour. This is divided among the copyright holders in proportion to how much you used from each—sliced very finely.

What keeps people from making copies? Nothing, since terminals are under the control of individual users; but since everything is still stored on the system and available instantly, the cost and inconvenience of making and filing private copies will be often seen as superfluous.

OVERVIEW: THE XANADU SYSTEM AS A VIRTUALITY

The above description specifies a general and powerful facility for business, literature, correspondence and digital storage of all kinds.

As such it represents a cohesive and unified virtuality which has been thought about and reworked for years. Its appearance of simplicity and obviousness is the distinctive quality of a carefully wrought design: *There are hundreds of other ways to do these things*, as experienced computer people well know; yet making the parts hold together clearly, complement each other, and *make sense*, takes a very great deal of work.

XANADU FRONT ENDS

Of the functions described above, only a few are actually handled by the Xanadu service network: *put this away* and *give me that in such-and-such a version* are really all that the Xanadu back-end machines do.

The rest has to be done, actually, in your personal computer. Marginal notes, for instance, require making a companion document out of your marginal notes, for instance, and declaring it and putting it away in the network. Most users will also want to keep track of how they have been jumping among various documents and activities. These necessary functions belong in your own computer.

Thus the "full" Xanadu system, as we recommend it be used, entails a cooperating program in your personal machine that acts in these ways.

Thus full Xanadu service has two parts. The "back end" is the proposed Xanadu network; esentially all it does is store and fetch by versions and links.

But a high-powered terminal is needed by the user, to show the documents sent by the back end, to present the possible actions the user may take, and to translate these choices into the proper fetch-and-store instructions for the back end.

This is of course the "front end." There are many possible ways to visualize and control the Xanadu functions—even before graphics or music are stored on the system—and we welcome imaginative front-end programs of any design, even if marketed independently. The Xanadu project will, however, offer guidelines for front-end design.

If you choose to use the back-end network in some other way, that is your privilege as a customer; but in order to encourage what we see as desirable modes of operation, we will be offering various trademarks to software vendors who wish to create cooperating front-end programs.

Given the overall virtuality of the Xanadu system, there are countless possible ways to summon, visualize and control its operations on screen. All of these are valid and welcome. To give some ideas of the possible varieties, I will discuss two very different Xanadu front ends.

(Since these are highlights of the two front ends, no attempt will be made to show all the functions, reconcile their different emphases, or intercompare them.)

THE XANATREK™ FRONT END

The standard Apple computer, laudable as may be its general qualities and capabilities, has a few conspicuous limitations. One is its text screen, only forty characters wide.

However, an Apple strength is fast-action low-res graphics. Two pages of hardware memory are dedicated to either text *or* low-res graphics. We will proceed to use this fact.

The Xanatrek front end has been designed for fast and exciting use of the Xanadu facilities, as well as for invigorating use of its low-res graphics.

The system was, quite frankly, inspired by *Star Wars*, and shows how far you can go in playful and analogous use of graphics.

One of the things a Xanadu user must be able to do instantaneously is ask exactly what he is looking at—that is, having jumped to something or wandered by degrees from his original activity, he

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Virtuality, cont'd...

needs an instant and valid explanation of what he is looking at.

Very well. While reading anything from the Apple screen (from page one of memory) the user may instantly demand a map of what he is seeing. This is continually available and up-to-date in low-res color, on page two. But aha, you say, how can you read it, since the color display disables the character generator? The answer is that the various patches of identifying text are indeed visible on this map as patches of seemingly random color, but since the Apple allows *one text window* on a low-res screen, successive boppings of a particular control will step the various text labels into a readable panel.

The most amusing visualization in the Xanatrek front end has to do with seeing the major features of a document such as chapter breaks and seeing links as well from a companion or other document.

This brings out the "Star Wars" styling. What the user sees looks like a huge passing spaceship or perhaps a packing crate, in the vault of night.

One of its visible sides shows the major parts of the text itself, as streaks of color. The other visible side shows the entrance points provided in your companion document. (You may select any of these places for your next trip.)

Other ships that pass in the night are documents linked to this one. Want to see the links? Hit a button, and animated squares *fire from one ship to the other*, with that p'tew p'tew sound we *Star Wars* fans have grown to know and love as the sound of a laser weapon in a vacuum.

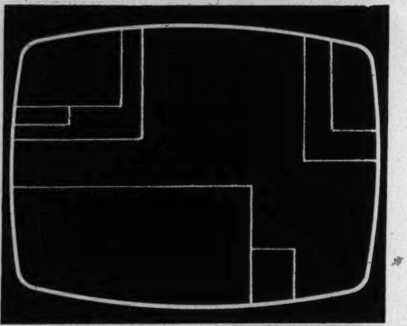
THE CORNERCOPIA™FRONT END

This Xanadu front end has been thought out for implementation on an actor language on a small Sorcerer computer.

There are many approaches to the design of screen panels. One approach, generally associated with Xerox PARC, strews panels diagonally on the screen. The approach that follows is intended to be a little easier.

Five to ten screen panels are accesible at a given time. They come out of corners of the screen.

Each panel keeps one free corner anchored in a particular corner of the screen. Its opposite corner remains always visible but may be moved by the user to any position which does not obscure any other panel's free corner. As with PARC panels, any "behind" panel may be instantly brought to the front without moving its borders.



Each panel is labelled with a one-line title (at the top of the lower panels or the bottom of the upper ones).

The text may show and scroll in any panel; naturally dependent or "parallel" text (a standard Xanadu statement) may scroll in any other visible panel with links to the independent text shown by scrolling symbols on the panel borders.

Perhaps this environment seems not to show enough. Very well: some panels themselves represent *other* such environments; when brought to the fore they swell up to become other multipanelled views.

OOF

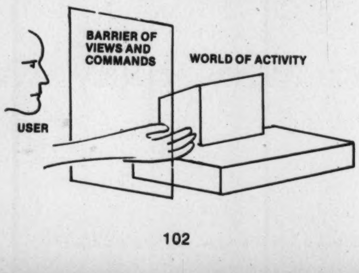
The "office of the future" will consist basically of cabinets for incoming correspondence, printers for outgoing correspondence, and in between, screens, screens, screens.

In this highly competitive area, harried programming managers everywhere are under pressure to work out what *happens* on the screens. But what do they, or *anybody*, know about it? It's *not a technical problem!* It's merely delegated like one.

The problem has nothing to do with technicalities; all of these are squared away. The problem is in the design of virtuality. But I know of few designers at present competent and imaginative enough to make those screens come alive and make working at them a joy. Which is the *real* problem.

WORLD AND VIEWS

An interactive virtuality is essentially a *world* created by a programmer or designer. This world has a certain structure which may be easy to understand or hard. This World is visible through different *views* allowed by the designer.



The World is what you're really thinking about; the view is the temporary way you're looking at it.

The distinction between World and View is crucial. The World is what the user is supposed to be acting on and thinking about; the View is all he really gets. (Controls are in a way part of the view.) If Views are good, the World comes to seem real, natural, at hand, under control. Poor Views (or worse, a hard-to envision world) create confusion and poor usability.

The system should have easy-to visualize states and conditions, and, preferably, some kind of spatial orientation that readily becomes a map in the user's mind.

The designer should begin by thinking about visualizing the *World*, not the Views, and let the Views come later.

(Yet designers are always getting seduced by particular views and treating them as the world itself.)

The principles of the World are the central, integral, virtuality; how you see it is secondary. It is important to acknowledge the cruciality of World design, and consequently the importance of the principles you develop for it.

The designer creates a simplification or stylization of the original world. There must always be some reduction or stylization; the important thing is that these reductions or stylizations not detract from the principal things you need to understand and control.

In transposing an old activity, the question is what to retain in the world and what to dismiss as part of the view. (For instance, Text Pages—divisions of text—are part of the View, not the World.)

Anything can be shown, any buttons or sticks or whatever, with any preentational machinery. People are always asking for bigger screens—but actually to ask for a bigger screen is usually a copout. Ask for higher performance. Faster flips and flaps and scrolls and panel pop-ins. Fast action and seething cues. Leave several things on the screen at once, to remind you of what you've been doing, what you might be doing, what else there is to do, and any other current options.

The operations in the user enviroment should feel more and more like operations on the world. As stated above, controls are in a sense part of a view. Anything can be controlled by almost anything, buttons or sticks or keyboards.

An interactive system should have very few controls and these few should have far-reaching and powerful uses.

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Virtuality, cont'd...

desired functions. Menus should be used, rather than input languages or the fictitious "natural language dialogue;" or better, yet, control diagrams.

Actions should be easily reversible and their consequences immediately recognizable so the user can back out of a mistake without being punished. (Compare this with the word-processor horror stories you hear all the time.)

Most important, the overall *principles* you choose for a system should be sweeping and have few or no exceptions. In order to clarify these issues we must consider the issues of both soft principle and soft clarity.

THE PHILOSOPHY OF SOFT PRINCIPLE

The following discussion has to do with the design of principles, which is in fact the essential issue.

SOME FAMILIAR IDEAS SOFTENED AND RECONSIDERED

	Hard	*Soft (or mixed)*
IMPLICATIONS, RAMIFICATION	Hard Implication, Consequences	Possibility, Tendency, Expectation, Connotation
PARADOX	Contradiction	Irony, Oxymoron
COMPLICATION	Obstruction, Interference, Contervailing Principle, Something in the Way; Amendment, Modification	Things to be Clarified, Resolved Worked Out

We frequently consider something and ask ourselves: *What are the implications of this?* And one of the nice things about science and technology is that the implications tend to be clear and exact.

In many cases, though, implications tend to be less certain. Implications don't follow clearly from premises. Those who want clear-cut answers become edgy or annoyed. The main tradition of Western thought has been to try to find the exact implications of every idea. (Ideas which don't seem to have exact implications, as well as people who *prefer* unclear situations, cluster in the humanities or "fuzzy studies.")

But some things are by their nature unclear in implication. These include both cluster-concepts ("Democracy," "Womanhood") and design ideas ("Let's see, maybe it could fold back onto itself somehow").

By tradition we often tend to talk of such ideas as improperly formulated or incomplete. I would like to put it another way and call a principle whose implications are inexact, a *soft* principle.

This throws things in another light. Rather than suppose the soft principle is just "not finished yet," let us consider it instead *another logical category*—somehow analogous to the conventional hard principle, but not subject to deduction.

If you can't deduce, how can it be logical? The answer may be that we've been looking at the wrong features of logic and have missed the analogy. There are in a sense soft equivalents to implication, contradiction, and other logical configurations. (See table.) I hope to develop these ideas more broadly at a later time.

What good is this analysis? At the very least it is suggestive. If a principle is *by nature* soft then we can understand it on its own terms rather than insisting that it hasn't properly hardened "yet."

Or take soft design ideas. A given idea could be worked out into hard form in numerous different ways. Some you may like better than others, and a variety may be valid.

Now take *several* soft design ideas, all at once. How do their ramifications fit together? The answer is *indeterminate*, since the ramifications of each could take many forms. But if you are aware of this, then you can search carefully for the *combinations* of possible workings-out, their variety and their interactions.

The "inspired" design of something final and precise comes, I believe, from sifting many such co-implications of possible hardenings of the ideas.

And the important guideline is: *don't rush it*. Don't take shortcuts. Don't assume that decisively pinning down one aspect of a design will speed things up; it's like nailing your left shoe to the floor.

If we think of design as the search of many possibilites, "soft design" is that which is sensitive to unexpected simplifications, conveyances and harmonies.

In short, *don't be too sure of what you're looking for, and be ready to appreciate the ramifications of surprises.*

Principles in Practice

Eventually, the soft design principles we have tried out lovingly must be hardened into specific hard forms of computer operation. What should the principles be like? Again tradition may ilitate against recognizing the best esign decisions.

The general principles of a system, *once chosen,* should be consistent, but "consistent" according to looser criteria than the designer may be used to. In particular, a design principle may be psychologically clear for people to work with, easily visualized or imagined, yet not reducible to any customary formalism.

Indeed, "consistency" here takes on a strong psychological flavor: a thing is consistent if users think it is consistent and use it consistently—even if we don't like it, like the double negative in Spanish. (We may call this naive consistency or soft clarity.)*

Thus the final chosen principles need not be "logical" in the rigid sense of conforming to somebody's predefined notion of how things should behave. But working out in soft form, we study their fittings-together in great detail.

The designer should eliminate any background notion that the user must be like him. All too many designers reward the user for being like himself, the designer, or punish the user for being different or thinking differently. The objective is to be of service, not to clone yourself.

TECHNICAL TRADITIONS VS. SOFT DESIGNS

The design of virtuality is essentially the design of operating principle. The design of principle, in turn, has to do with the generation and modification and inter-sculpturing of soft principles.

The biggest design problem though, is that the designer tends to freeze too quickly on a particular set of rules and arrangements. Technically-oriented people tend to seize one or two principles and hang onto them through thick and thin, not perceiving when it is time to rework their ideas.

I have learned through bitter experience, indeed, that only a small proportion of technical people are even capable of *listening* to this viewpoint. The soft design of virtuality seems to be totally alien to technical training.

---

* Mark Miller, who worked on the original JOT system, considers it a consistent virtuality, even though it "corresponds to no known paradigm of program structure."

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Virtuality, cont'd...

Those who design interactive systems tend to be technically trained, and technical training generally promotes the background assumption that what you are working on is given and well-defined.

Training in the arts and creative fields, on the other hand, promotes the ideas that a design (or piece of writing or a movie) is fluid, may take many forms, and will be reworked over and over until it reaches a final state that may be wholly unlike its earlier stages. I believe this latter outlook is far more appropriate for the design of interactive systems.

CONCLUSION

Interactive system design is a field in itself, utterly unlike what is taught in any computer science department I know of. If I have not proved this point, I hope the designs and ideas presented here will at least provoke some unease.

(This is no claim that these designs are righter than any others; but rather that these designs are a unified package that feels right and is therefore of interest. They represent local peaks in design space, in the sense that small changes would, I think, detract from their unity and clarity.)

These designs represent hundreds of hours of work, but the difficulties of the decisions and the rough edges don't show. (That's part of good design and art).

The art of designing things in general is very little understood. People think that something is well-designed if it is *sleek*, *stylistically unified*, and *if its controls look as much alike as possible*. (An example is the "designer" audio equipment from Bang and Olufsen, show at the Museum of Modern Art and copied everywhere, where every control resembles every other control.)

This approach is wrongheaded beyond belief. (I think stereo equipment is poorly designed, and B&O the worst of them.) You do not want controls that look alike. You want controls that look and feel *different*. If you have a big round knob for the volume control, you should have a square knob, or a slider, for the tuning. There should not be a row of similar buttons for different functions, but a row of *different* buttons—or better, not in rows, but some other arrangement contrastively arrayed. Do you need glasses to read what it says above the knobs? Lousy. Can you tell at a glance one control from another? Good. CAN YOU WORK IT IN THE DARK? Terrific.

As a rough guide, *good design is inversely proportional to the probability of a user making a mistake*. And this criteria carries over to interactive computer systems.

To make a system easy to use is extremely difficult and time consuming, in the same way that it takes more work to write a short article than a long one.

You should not "design the system" first, and then put on a "friendly front end", (although this is what must be done in many cases), any more than you should first shoot a movie and decide what it is to be about (although this occasionally works).

An interactive system should become second nature, and become second nature quickly. This is essential for many reasons. One is that we will have to move among many different interactive systems in the future, and there will be no time to savor and adapt to the local complications of each. They will have to spring clearly and straighforwardly at the mind and hand.

Moreover, interactive systems will be used intensely for hours, often by tired, high-strung, frantic people, who are trying to get a job done in a hurry, and who are thinking only of the world they are trying to operate in—not the intervening complications. It is up to us as designers to create fast, safe, elegant systems of view and operation without snags, dangers or complications.

The system designer, or movie director—let's call him *you* —must have a full understanding of what things are easy to do, what things are not, and what is hopelessly impossible. You then make a collection of all the ideas and visualizations (and scraps and parts) you would like to put together in your system. Then your rework them and rework them, and rework them.

THINK OUT THE WORLD

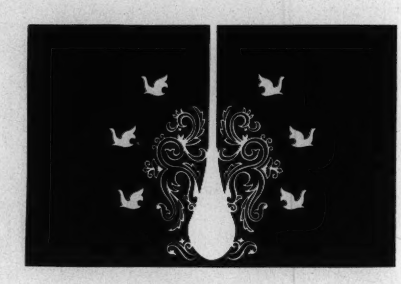
—Its many views and aspects; it s *real* nature (unlike what has been thought of as its nature);

IMAGINE ALL THE CONTROLS AND PRESENTATIONS YOU'D LIKE TO HAVE,
REDUCE THE CONTROLS
AND PRESENTATIONS
TO AN ADEQUATE,
POWERFUL,
EASY-TO-UNDERSTAND SET:

MARRY THEM TO THE AVAILABLE SCREENS, KEYBOARDS AND POINTING TOOLS.

ABOVE ALL, DESIGN THE FULLEST SYSTEM FIRST—THEN CUT IT DOWN, IF YOU HAVE TO. YOU MAY FIND YOU DON'T HAVE TO.

That this is nowhere taught is much worse than regrettable. Because unfortunately the salaried programmer has, in effect, a license to inflict on innocent users anything he likes under the pretense of technical necessity or on the basis of some off-the cuff (or cufflink consultant's) assessment of "user needs."



I regard the decisions involved in designs like those as intricate and interdependent as moves in chess. This kind of design needs a respect and even reverence for the far-flung ramifications of tiny decisions, and the staggering complexity of making things simple.

I hope I have given a sense of this style of design.

I hope, too, that the reader will see it as an art form—somewhere between movies, diagramatics, the design of machinery, the design of games, and the building of philosophical systems.

When done well, it is done with simplicity, consistency, conceptual clarity and vividness. This is not "technical" work in any usual sense. I consider it a form of design and a form of art.

I believe that interactive design is, more than anything else, what the computer field is really about. I find it monstrous and appalling that these general principles are so little understood; that despite all the pompous "computer science curricula," nobody teaches these anywhere; and that innocent customers who want an easy-to-use system—really, is it too much to ask?—are too often led by consultants and tekkies down a primrose path to endless horrors of complication and unnecessary claptrap.

How you feel about all this depends on what you think computers are all about and where the world should be going.

If you want to show off to your family and friends—or financial backers—as a macho master of complicated technicalities, then you don't *want* things to be easily comprehensible. (In that case you should be reading certain other personal computer magazines.

But if you believe that somewhere beyond all the technicalities lies some kind of hope for a better future and a smarter mankind, rich in ideas and knowledge and dreams—as well as gadgets—then the question is how to front-end the gadgets so that they bring us knowledge, and ideas, and dreams, without the technicalities being in the way.

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Interview with Clive Sinclair

David Ahl

Clive Sinclair is the man behind the first mass pocket calculator, the first scientific calculator kit and, now, a mass-market computer. I talked to Clive while in London at the PCW show.

Ahl: How did you get started in the electronics business?

Sinclair: I started in 1962 when I first came to Sinclair Radionics. We were in the kit business with hi fi systems and pocket calculators, (we made the first pocket calculator which is on display in the Museum of Modern Art in New York). From there we went into digital watches and TV sets and for a while we were linked with a government body in the U.K. At this point I left, as this arrangement did not work out too well. I took the same people with me and reformed the company as Sinclair Research Ltd. and launched the personal computer.

Ahl: Does Sinclair Radionics and its products still exist?

Sinclair: Only as a legal entity, but it doesn't trade.

Ahl: So effectively today your main product is ZX80?

Sinclair: That's right, but it's not our main research program. Our biggest research/development program is on flat screen television.

Ahl: Have you shown that at all? Or proved its capability?

Sinclair: Yes we have. We are at the stage where we have demonstrated it and will be doing so again later this year. We have pilot production and hope to shortly be at the next stage.

Ahl: What type of technology is used?

Sinclair: It is a flat screen Cathode Ray Tube.

See a review of the Sinclair ZX-80 on page 28.

Ahl: Does it have electron guns?

Sinclair: It has a conventional electron gun, but instead of the beam following a straight path, it bends to a right angle and it splits the screen.

Ahl: Is it monochrome or could it be color?

Sinclair: It is monochrome today, but eventually it will be color. We will pursue that.

Ahl: That sounds very interesting. Sharp had shown one about two years ago which provoked much interest in the electronics community but nothing ever came of it. Today it doesn't look like they are any closer to a commercial product than two years ago.

The philosophy of the company is very clear—to lead in technology.

Sinclair: What Sharp showed was an early development model of vertical projection, which, novel as it was, was a long way from a commercial product. But that is not the case with ours. Ours gives a picture which is not simply as good as a conventional Cathode Ray Tube, but it is better, and all the snags have been ironed out.

Ahl: Do you anticipate that the price of this will be competitive with the existing technology?

Sinclair: Absolutely. There is no way we would introduce something which cost more than existing technology. Not only does this have more feature advantages, it has price advantages over conventional technology. But in order to achieve this and because conventional tubes are made in such vast numbers, the only way it can be competitive is to have very large scale production. That is why it will take quite some time before the tube emerges.

Ahl: About the ZX80; how long has that been in development?

Sinclair: It started in March 1979 and it was put on the market in February 1980.

Ahl: How many people were involved? It seems to be quite a breakthrough on many fronts. Did you have simultaneous projects going on to bring it to fruition? Or was it mainly you, or a small team of people?

Sinclair: There were very few people involved really. I had the original idea and some of the system ideas. Then there were about two or three engineers who were involved in the detail and design; one engineer in particular did the final design and one wrote the software.

Ahl: Some people look at it and conclude that it is no more than a larger computer scaled down to smaller dimensions, while others will look at it and think of it as one of those language translators with a little more capability. From glancing at the specifications and seeing it at the Consumer Electronics Show, I have the impression that it has much more capability than that and that it does not seem to be just a scaled down computer. What is your concept? How do you view the machine?

Sinclair: While the ZX80 is a true computer in every sense, without any inherent limitations, it obviously was restricted in performance in its minimum configuration. We wanted to sell at as low a price as we possibly could, a computer upon which people could start to learn, really seriously, how to break into computers and how to really learn what computers were about. Now that might be an end in itself for many of them, but these may be executives who want to understand computing so when they buy computers for their firms or talk to people about the use of computers in their firms, they do so from a knowledgeable standpoint and they don't feel awed by it. Equally, we see it as a very powerful aid for students wanting to

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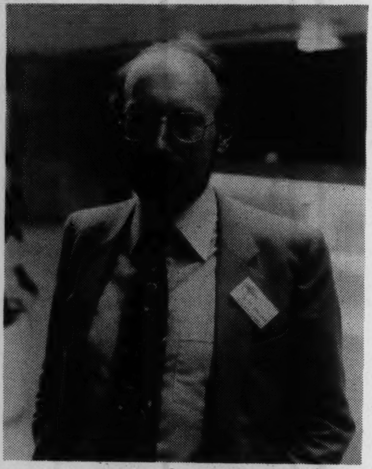
Ahl: Is that Basic compatible with Micro-Soft Basic or some other Basic on the market or has it got a lot of bells and whistles that make it incompatible with others?



Sinclair: It is not compatible. It is our own. We had to take that step in order to achieve the bells and whistles that you mentioned and have those features that we feel are important to our customers. In order to hit our cost goal we had to do a better packing job than had been done before. The ROM in our basic machine is just 4K bytes which contains everything — Basic, operating system, keyboard control and display I/O. Now there is no way we could have done all that with an off-the-shelf Basic. Furthermore, we then pack data into the RAM at least four times as tightly as anyone else. We would not have been able to do that unless we had our own Basic. Another thing that we wanted was keyword entries. You may have noticed that by pressing a certain key a keyword is entered. So there is very little for a non-typist to do. A lot of people are put off in the learning stages with having to type PRINT every time and abbreviations can be misleading. We felt this was very crucial and it is not included in standard Basics, so we had to choose to go away from the existing patterns.

Ahl: Pertaining to the marketing of the ZX80, do you anticipate selling it through computer stores, department stores, or other types of outlets or through direct-mail as you have done with some of your other products?

Sinclair: We are going to sell the computer by direct-mail in England and the U.S. There may come a time when store distribution is possible, but you can't really distribute to a store until you have a much better informed public. A very large mail-order campaign may help do that, so it may be possible later to distribute to stores.

Ahl: Many people buying computers today, particularly at this price level, are concerned with where or who can they go back to for service, particularly if they buy a machine by direct-mail.

Sinclair: There are two points there: the first involves the product, the second is who to come back to for service. We have a permanent office in the States and we stand behind our product at all times. We haven't seen anything but 1% or under 1% failure rate in the field in the U.K. It is a very reliable product so we haven't got a serious problem. We operate with service contract houses and this is all part of the guarantee of the product.

Ahl: Jumping back to the technical aspect of the ZX80, it appears that although now that it is designed for a power supply to be plugged into standard power, it could probably be battery operated and completely portable. Is this in your plans?

Sinclair: Yes it is. It has a very low power consumption and could certainly run for a reasonable time on batteries. Of course you need a battery T.V. set as well.

Ahl: What about other peripherals, floppy disk, mass storage, printers etc.? Are they in the works?

Sinclair: Yes they are, we have a floppy disk coming in about a month; the other items should be out the middle of next year.

Ahl: How do you feel about other alternative forms of mass storage? Some people have said that the bubble memory is coming down in price fast enough that it may in two or three years replace the floppy disk as a mass storage device. Do you think that's likely to happen?

Sinclair: The price projections we see from manufacturers over the next two or three years don't suggest that to me.

Ahl: What else would you like the world to know about you, the product, philosophy etc?

Sinclair: The philosophy of the company is very clear — to lead in technology. We've got a good start in this field and we plan to take as good a lead as we can. Some of the things we are developing, such as the flat TV screen, a truly portable system, etc. are coming along too. Clearly we think these are things we can do. □

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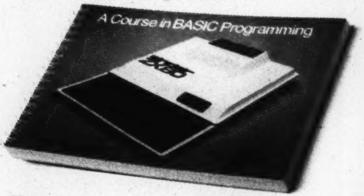

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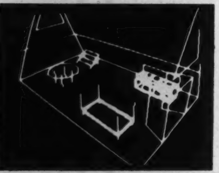

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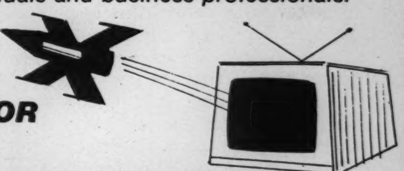

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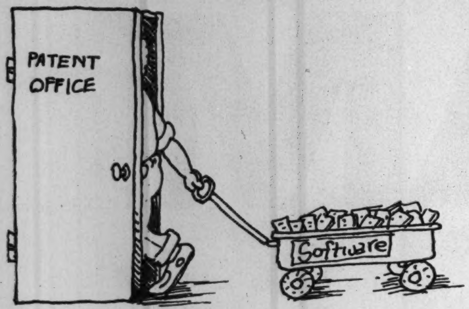

The Legal Protection of Computer Programs

Ross Olmstead

The ownership rights associated with computer programs and data bases should be afforded the same legal protection as is available to other kinds of creative ideas and expressions. Although there are few people who would disagree with this statement, there has been considerable disagreement as to how it should be done. Over the decades, different laws have been developed to protect different kinds of creative works. But computer software is not quite like anything that preceded it. On the one hand, a software package may be thought of as a work of authorship. On the other hand, it is functionally mechanistic. Things are further complicated by the fact that it has become remarkably easy to quickly copy large amounts of information. Of course, the easier it is to reproduce a protected work, the harder it is to protect it.

The confusion and disagreement among those caught up in the necessity of applying old laws to new phenomena was brought into focus during the seventies as Congress attempted to overhaul the 1909 copyright laws. Although a new Copyright Act was finally passed in the fall of 1976 (effective January 1, 1978), Congress decided that the implications of data processing and reproduction technology had to be further clarified before they could be properly reflected in the new law. In order to allow for this they did two things. They inserted a stop-gap paragraph pertaining to computers in the new law, and they created a commission to further study the issues. The paragraph reads:

#117. Scope of exclusive right: Use in conjunction with computers and similar information systems.

Notwithstanding the provisions of sections 106 through 116 and 118, this title does not afford to the owner of copyright in a work any greater or lesser rights with respect to the use of the work in conjunction with automatic systems capable of storing, processing, retrieving, or transforming information, or in conjunction with any similar device, machine, or process, than those afforded to works under the law, whether title 17 or the common law or statutes of a State, in effect on December 31, 1977, as held applicable and construed by a court in an action brought under this title.

Section 117 is a holding action which indicates that old laws, as inadequate as they may be, still pertain.

The National Commission on New Technological Uses of Copyrighted Works (CONTU) was first convened in 1975 and issued its *Final Report* in 1978[1] In addressing the copyright problems of data processing, CONTU examined the various existing laws that could presumably be used to protect data bases and software, and recommended changes in the new copyright law to reflect their findings. My discussion of the issues involved is based largely on the CONTU reports.

The confusion and disagreement among those caught up in the necessity of applying old laws to new phenomena was brought into focus during the seventies.

There are four specific areas of law that have been perceived as available for the general proprietary protection of computer data bases or software. These are trade secrecy, unfair competition, patent and copyright.

Trade Secrecy

The laws of trade secrecy are administered by the States and vary somewhat from state to state, thus resulting in a lack of uniformity and in varied interpretations. The common purpose of the various state laws is to recognize that legitimate competitive advantage, in whatever form, is private property and should therefore be afforded legal protection. A person who, without authorization, appropriates or reveals a trade secret is guilty of theft. As CONTU points out, however, trade secrecy is hostile to the free exchange and dissemination of ideas, and is inappropriate with respect to general purpose computer programs or data bases having a potentially wide-scale commercial distribution. The maintenance of trade secrecy requires stringent security and, once the secret is disclosed, protection becomes generally unenforceable. The wider the distribution of a specific computer program, the more expensive and difficult, if not impossible, it becomes to keep the program a secret, especially since the nature of a computer program is usually obvious to the trained observer. Furthermore, the remedies against illegal appropriation are limited. Generally speaking, there is only a oneshot remedy because, once disclosed, the program will cease to be a secret. If the owner decides to bring suit, the necessity of proving the validity of a trade secret may be expensive and difficult, often involving the retention of expert witnesses. And, of course, secrecy may be lost when a secret is introduced as evidence, becoming part of the public record of the trial.

Unfair Competition

The common law doctrine of unfair competition is also part of State law and is thus subject to the same lack of uniformity as trade secrecy. The law, in general, is based on the principle that it is unfair to appropriate a competitor's skill, expenditure, and labor, or to represent such properties as one's own. For example, obtaining a copy of a computer program and selling it as one's own creation, when it was actually written by someone else, would amount to unfair competition. But this law does not prohibit the unauthorized copying of a program for use as opposed to sale, and thus is severely limited in its power to protect.

The United States constitution, in listing the powers of Congress, specifies that Congress shall have the power "to pro-

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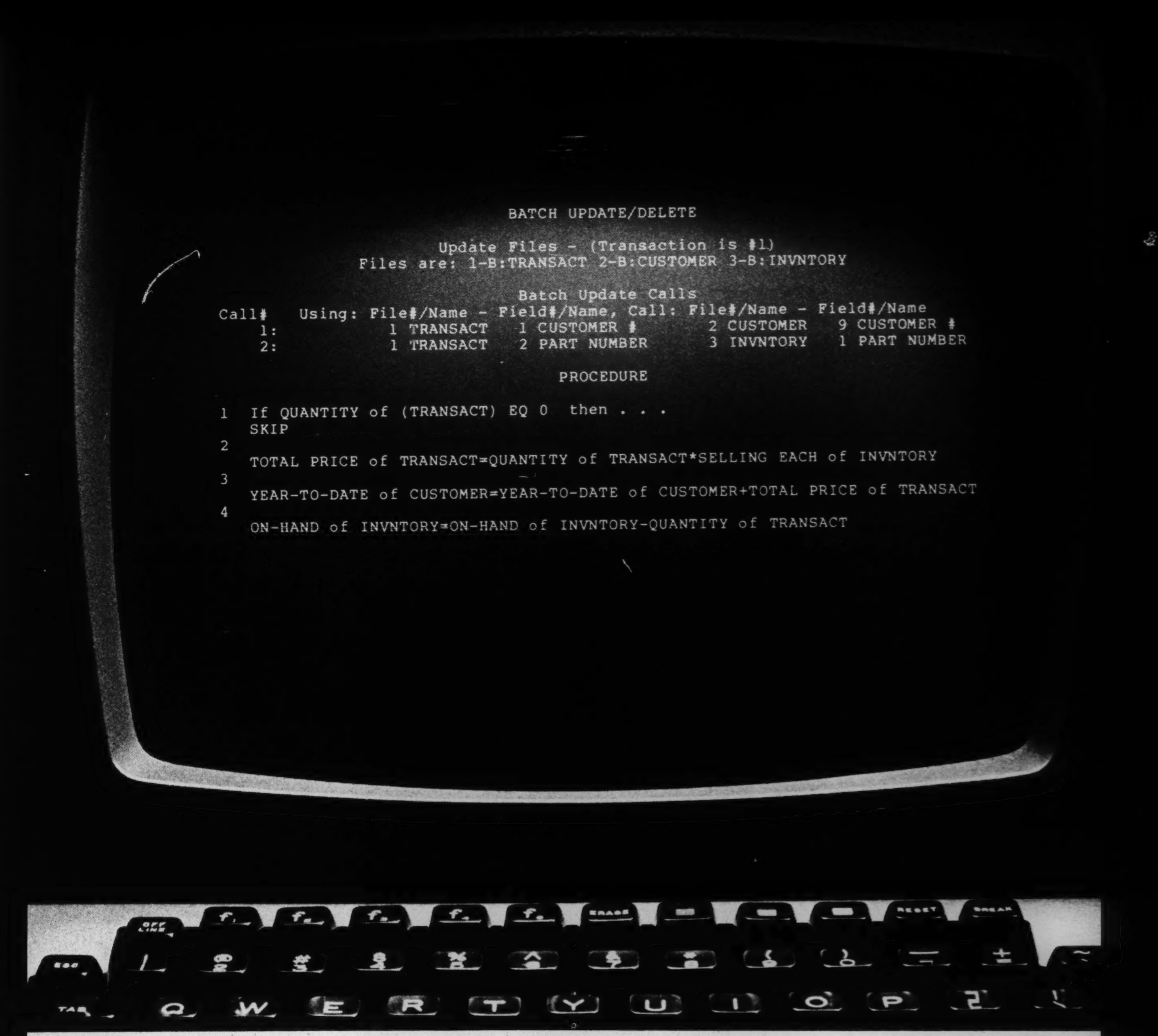
Ross Olmstead, 58 Grand Ave. #20, Oroville, CA 95965.



```
                         BATCH UPDATE/DELETE

                  Update Files - (Transaction is #1)
             Files are: 1-B:TRANSACT 2-B:CUSTOMER 3-B:INVNTORY

                          Batch Update Calls
Call#   Using: File#/Name - Field#/Name, Call: File#/Name - Field#/Name
    1:           1 TRANSACT   1 CUSTOMER #        2 CUSTOMER   9 CUSTOMER #
    2:           1 TRANSACT   2 PART NUMBER       3 INVNTORY   1 PART NUMBER

                              PROCEDURE

1   If QUANTITY of (TRANSACT) EQ 0  then . . .
    SKIP
2
    TOTAL PRICE of TRANSACT=QUANTITY of TRANSACT*SELLING EACH of INVNTORY
3
    YEAR-TO-DATE of CUSTOMER=YEAR-TO-DATE of CUSTOMER+TOTAL PRICE of TRANSACT
4
    ON-HAND of INVNTORY=ON-HAND of INVNTORY-QUANTITY of TRANSACT
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Protection, cont'd...

mote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive rights to their respective writings and discoveries (Article I, Section 8)." Congress has exercised this power by enacting patent and copyright laws, both of which have some advantage over trade secrecy and unfair competition in that infringers are more likely to be persuaded to comply without the institution of a lawsuit. If a lawsuit does arise, trade secrecy laws require that the plaintiff prove the validity of the secret. In patent cases there is a presumption of validity, and in copyright actions a registration certificate is direct evidence of copyright's validity.

Computer software is not quite like anything that preceded it.

Patent

Patent law is set forth in Title 35 of the United States Code. It affords strong protection, for a period of seventeen years, to demonstrably useful, novel, and nonbvious inventions. Whereas copyright is designed to protect the "expression" of an idea or process, patent is designed to protect inventions, which are ideas or processes in themselves. Although there have been patents awarded to software, the rigid standards of novelty and nonobviousness would seem to preclude the awarding of patents in most cases. furthermore, the availability of patent protection to software is now unclear. The U.S. Supreme Court has found computer programs to be ineligible for patent protection in two cases. In November of 1972, in *Gottschalk v. Benson* (409 U.S. 63), the Supreme Court

> "held that (a) computer program (is) a mathematical formula without substantial practical application except in connection with (a) digital computer (and) was not a patentable process."

In *Dann v. Johnston* (425 U.S. 219), a patent was sought for software which provided a bank with automatic record keeping of bank checks and deposits, and produced specialized account transaction records for the bank's customers. In March 1976, the Supreme Court decided that the software in question "would ... have been obvious to one 'reasonably skilled in (the applicable) art'"and was, therefore, unpatentable. This last decision emphasizes the potential difficulty in meeting the patent law's test of nonobviousness.

Copyright

A clear case can be made for considering computer programs and data bases as works of authorship, and thus qualified for copyright protection. The 1976 Copyright Act provides protection for

> "original works of authorship fixed in any tangible medium of expression, now know or later developed, from which they can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device (Section 102 (a)."

Works that can be communicated only with the aid of a computer are thus within the copyright law's scope of protection.

In 1964, the Register of Copyrights agreed to accept computer programs for registration provided that 1) they contained sufficient original authorship, 2) they had been published, and 3) copies submitted for registration were in human-readable form.

Point number 1 is still a valid requirement for two reasons. Very simple and obvious programs are not only lacking in originality, but may well be the only means by which to accomplish a given task. Such very basic programs are then closer to "ideas" than "expressions," and, as stated earlier, copyright protection is available only to expressions. Point number 2, publication, is not required by the new Copyright Act, but both publication and registration provide some extra margin of protection. Firstly, they provide a public record of ownership in the event of copyright violation. And secondly, they may entitle the copyright owner to an award of statutory damages and attorney's fees, remedies not otherwise available. Point number 3 has been a bone of contention and requires some background discussion.

In 1908, the Supreme Court held that a piano roll was not a "copy" of music because it was not, for most purposes, human-readable. *(White-Smith Music Publishing Co. v. Apollo Co.*, 209 U.S. 1). For similar reasons, it has been argued that a program in object code lacks communicative potential and might therefore be constitutionally uncopyrightable. But, as CONTU points out, copyright protection has been extended by the courts to such diverse works of authorship as freight tables *(Guthrie v. Curlett*, 36 F. 2d 694), interest tables (*Edwards & Deutch Lithographing Co. v. Boorman*, 15 F, 2d 35), and lists of otherwise meaningless fiveletter code "words" (*Reiss v. National Quotation Bureau*, 276 Fed. 717). These works of authorship, like computer programs, are valued for their utility rather than their artistic merit.

As to the applicability of copyright to data bases, such creations are appropriately defined as compilations, which are protectable under copyright (Section 103). Compilations are defined, in Section 101 of the new law, as works

> "formed by the collection and assembling of preexisting materials or of data that are selected, coordinated, or arranged in such a way that the resulting work as a whole constitutes an original work of authorship. The term 'compilation' includes collective works."

The extension of copyright protection to compilations has evolved over the years out of several court cases. In 1937 telephone books were afforded copyright protection (*Leon et al v. Pacific Telephone and Telegraph Co.*, 91 F. (2d) 484). In 1922 a directory of jeweler's trade marks was held to be copyrightable (*Jeweler's Circular Pub. Co. v. Keystone Pub. Co.*, 281 F. 83). The Court decided in this case that:

> "The right to copyright a book upon which one has expended labor in its preparation does not depend upon whether the materials which he has collected consist or not of matters which are *publici juris*, or whether such materials show literary skill or originality, either in thought or in language, or anything more than industrious collection. The man who goes through the streets of a town and puts down the names of each of the inhabitants, with their occupations and their street number, acquires material of which he is the author. He produces by his labor a meritorious composition, in which he may obtain a copyright, and thus obtain the exclusive right of multiplying copies of his work."

It seems clear that computer data bases must be accorded the same protection as compilations in traditional hard-copy format. But their remains one point to be clarified. In order for a copyright to be registered, Section 407 of the new law requires that copies of the work be deposited in the Library of Congress. Because a data base is dynamic in nature, subject to constant updating, it is pointed out that a deposit reflection every new updata is impractical. Furthermore, a proprietor, by virtue of the constant updating, could claim copyright in perpetuity, rather than the 75 years now allowable. But, Sections 407(c) and 408(c) authorize the Register of Copyrights to exempt categories of material from the deposit requirements, or to require alternative forms of deposit. Data bases could presumably be treated in the same fashion as are new editions of telephone books, which require periodic registration renewal.

The owner of copyright in a work has the exclusive right to copy or authorize copying of the work, as well as to prepare derivative works based upon it. Accord-

Protection, cont'd...

ing to CONTU, the placement of a copyrighted work into a computer is merely one form of reproduction. Nevertheless, there are limitations to the exclusivity of protection. The "fair use" doctrine of the Copyright Act (Section 107) allows limited, unauthorized reproduction for production for educational and informational, as opposed to commercial, purposes. For example. whenever a single photocopy of a copyrighted magazine article is made for an individual's educational or informational use, legal permission to do so is ordinarily afforded by the "fair use" doctrine. More specific to computer programs and data bases, once a copy of a work has been rightfully acquired, it may become necessary for the user to make an archival copy or to convert a work from one computer language to another (i.e., prepare a derivative work). Such necessary, but limited, inhouse copying should be provided for in the copyright law.

Copyright protection is available only to expressions.

CONTU'S Final Recommendations

CONTU concluded that copyright protection should be specifically extended to computer programs and data bases for two fundamental reasons. Firstly, it is unreasonable and inefficient to create an entirely new layer of legal protection when the laws of copyright can do the job effectively and inexpensively. Secondly, copyright law serves to balance conflicting individual and societal needs. Works of authorship need to be widely available if they are to be of full value to society, and yet the individual author needs to be protected against unauthorized duplication so that the costs of authorship can be spread over multiple copies and thus recovered.

CONTU goes on to recommend that specific regulations concerning notice, deposit, and registration of computer programs and data bases be developed by the Register of Copyrights. Copyright notice ("Copyright," the abbreviation "Copr.," or the symbol ©, together with the year of publication and name of the copyright owner) should be printed or coded so that the notice is immediately apparent when a work appears in human-readable form. Notice should also appear on external packaging, including such things as preprogrammed semiconductor chips.

It is also suggested that certain changes be made to the new copyright law in order to spell out the specific authorization and scope of copyright's applicability to computer programs. Section 117 as enacted should be repealed. To Section 101, which is a list of pertinent definitions, CONTU suggests that the following be added:

"A 'computer program' is a set of statements or instructions to be used directly or indirectly in a computer in order to bring about a certain result."

CONTU also proposes that Section 117 be replaced with the following:

"#117: *Limitations on exclusive rights: computer programs* Notwithstanding the provisions of #106, it is not an infringement for the rightful possessor of a copy of a computer program to make or authorize the making of another copy or adaptation of that computer program provided:

(1) that such a new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner, or

(2) that such a new copy or adaptation is for archival purposes only and that all archival copies are destroyed in the event that continued possession of the computer program should cease to be rightful. Any exact copies prepared in accordance with the provisions of this section may be leased, sold, or otherwise transferred, along with the copy from which such copies were prepared, only as part of the lease, sale, or other transfer of all rights in the program. Adaptations so prepared may be transferred only with the authorization of the copyright owner.

The foregoing passage was designed to make it clear that neither the "inputting" of a program by a rightful possessor, nor the archival storage of a program as insurance against such things as accidental erasure, is an infringement of copyright.

According to the U.S. Copyright Office, copyright protection is currently available for computer programs, but not for data bases. Protection lasts for the life of the author plus 50 years, or, in the case of a work made for hire, a total of 75 years. A program is coyrighted by sending one copy or print-out of the program, along with a completed application Form TX and $10.00, to the United States Copyright Office, Library of Congress, Washington, D.C. 20559. Copies of Form TX, "Application for Copyright Registration for a Nondramatic Work," are avilable free from the above address. Publication of a work is no longer required for copyright protection.

Although CONTU's recommendations were presented to Congress in July of 1978, a bill to incorporate these recommendations into copyright law has yet to be introduced. Judging from the pace of copyright reform in the past, action by Congress will be anything but swift. ☐

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CIRCLE 229 ON READER SERVICE CARD

Logic Problem Solver

Tom Pratt

Have you ever been baffled by those mind-teasers called logic problems? Ever get the temptation to take a peek at the solution, but just feel too guilty to do it? This program offers you a happy medium — an alternate to cheating.

The key to solving logic problems lies in the interpretation of the given information. After properly interpreting what is given, the bulk of the time spent solving your logic problem will be in carrying out mechanical calculations. So, instead of wasting precious hours and risking mistakes, why not let the computer carry these out for you?

This program was written for my SWTPC 6800 w/16K and Robert Uiterwyk's Basic version 2.0. I have used commands that are common to most all Basics. It will use approximately 8K on top of the basic interpreter.

Using a computer to solve logic problems still leaves you with a fair amount of mental exercise. You must first make equations out of the statements used in the logic problem. For example, take a look at the sample logic problem. It is composed of four groups, each having five members. Let's call the group composed of Arkansas, Baltimore, Carson City, Daytona and El Dorado Group 1. The group of Rawhides, Superstars, Triplers, Underdogs and Victors will be Group 2. Group 3 will be the order of finish in this year's pennant race, and the order of finish in last year's pennant race will be Group 4. Also, either a "T" (for "this year") or an "L" (for "last year") will follow the numbers used for the order of finish. So, "1L" means first place last year, and "5T" means fifth place this year.

In making equations out of the logic problem statements, there are a few rules to follow. Obviously "<>" represents "not equal to" and "=" represents "equal to." But in an inequality, you must make a normal inequality statement (using "<" or ">") plus you must add what I call a "group specifier" and a "position specifier." The first statement of the sample logic problem says "This year, Baltimore's team finished one place higher than the Rawhides, who finished one place higher than last year's fourth place team." Since the inequality Baltimore > Rawhides takes place in this year's order of finish, and since we are calling the group of this year's order of finish Group 3, the group specifier is 3. Since Baltimore's team finished one place higher than the Rawhides, the position specifier is 1. Put all together, the inequality should look like this: Baltimore > Rawhides,3,1. Now, if the statement said "This year, Baltimore's team finished higher than the Rawhides," you would not know the position specifier, so you would use a zero as the position specifier: Baltimore > Rawhides,3,0.

You must make all possible equations out of the logic problem statements (that is, equations that do not restate other equations). Again, referring to the first statement of the sample logic problem, you should get the two following equations: Baltimore > Rawhides,3,1 and Rawhides > 4L,3,1. In addition, you might also want to say: Baltimore <> Rawhides and Rawhides <> 4L and 4L <> Baltimore, but these are unnecessary. You are merely restating the first two equations (if one thing is greater than another, they certainly are not equal!). You can, however, do this to make sure you have covered all possible equations.

After figuring all of the equations from the logic problem statements, you must type them in as data lines in lines 6000-6999. Remember to separate each character entry with commas.

You are now ready to run the program. The computer will ask "How many equations?" This means how many equations did you type in the data lines. It will then ask for "members in order." Type in the members in the numerical order that you have designated the groups i.e., first type in the members of Group 1, then of Group 2, etc. If, in an inequality, a group specifier deals with the group you are to type in (in the sample logic problem, groups 3 and 4), you must type in the members of that group in ascending order. In the sample run, since 1T and 1L are the highest rank, I consider these to be the greatest values and consider 5T and 5L to be the lowest values. Therefore, I type in Group 3 starting with 5T and ending with 1T and Group 4 starting with 5L and ending with 1L.

Since poke and peek commands are used in the program to conserve memory, use caution as to the memory locations used to store and retrieve these numbers. Otherwise, you could bomb your program, as well as your basic, or end up in a continuous loop — all of these being undesirable. However, there is an alternative to using these commands, but requires more memory (20K instead of 16K). It is the use of the array (D(24,24). All you must do is change the poke and peek statements to D(n,n) statements. I think it can be best explained by use of examples:

Poke statements

The statement POKE(S+X*20+X,3) should be changed to D(X,X)=3. The statement

POKE (S+G(X)*20+G(X+1),2)

should be changed to

D(G(X),G(X+1))=2.

Peek statements

The statement PEEK (S+X*20+Y) should be changed to D(X,Y). PEEK (S+G(X+1)*20+G(X)-1) should be changed to D(G(X+1),G(X)-1). I think you understand. You will have no problems at all if you follow these examples.

This program solves most logic problems and could be modified to solve any logic problem. It takes my computer about one hour to solve a four group-five member logic problem. Since most basic interpreters are much quicker than SWTPC's, using this program on other systems could speed up run time considerably. If you would like to attempt to cut down run time by modifying the program, I suggest you rearrange the order of routines (lines 1060-1077) that the computer executes.

Good luck in using the program. I hope you enjoy using it as much as I did writing it.

Tom Pratt, 6101 Hoffman Lane, Fair Oaks, CA 95628.

If you just bought another printer, boy are you gonna be sorry.

Epson.

The Epson MX-80. It's not just another worked-over rehash of last year's model. It's our top-of-the-line 80-column printer. It's new. From the ground up. And it's the most revolutionary printer to hit the market since Epson invented small printers for the 1964 Olympics in Tokyo. Don't take our word for it, though. Compare. There simply isn't a better value in an 80-column printer. Period.

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We spent three long years developing the MX-80 as the first of a revolutionary series of Epson MX Printers. We employed the most advanced automatic assembly and machining techniques in existence to produce a printer that is incredibly versatile, remarkably reliable and extraordinarily inexpensive. It's a printer that could only come from the world's largest manufacturer of print mechanisms: Epson.

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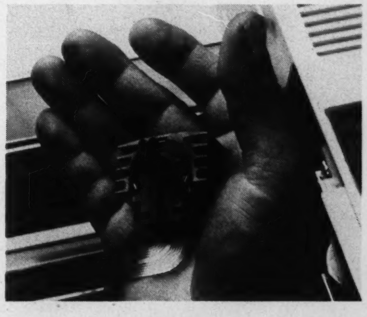

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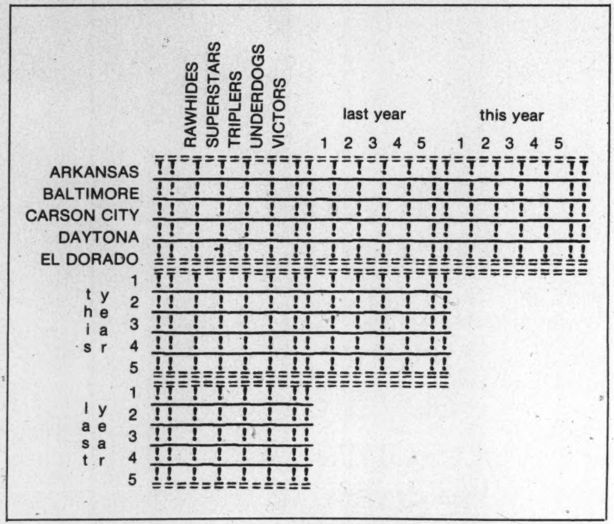
CIRCLE 208 ON READER SERVICE CARD



SAMPLE LOGIC PROBLEM

Pennant Race

From the following clues, can you deduce the complete name of each team, and the order in which the teams placed both this year and last year?

1. This year, Baltimore's team finished one place higher than the Rawhides, who finished one place higher than last year's fourth place team.
2. Last year, Daytona's team placed ahead of the Superstars.
3. Arkansas' name is not the Rawhides or the Victors.
4. Last year's pennant winner placed third this year.
5. This year, the Superstars finished one place higher than last year's fifth place team, who placed ahead of Arkansas' team.
6. Carson City's team did not place third last year.
7. The Underdogs placed higher than the Victors this year.
8. No team finished in the same place both years.

```
READY
#RUN

INSTRUCTIONS- TYPE IN YOUR EQUATIONS IN
DATA LINES 6000-6999. WHEN THE COMPUTER
ASKS FOR 'MEMBERS IN ORDER'(LINE 40)
YOU MUST TYPE IN THE MEMBERS GROUP BY
GROUP.  ALSO, IF THE MEMBERS OF A GROUP
HAVE AN ASCENDING ORDER, YOU MUST TYPE
THEM IN IN THAT ASCENDING ORDER

HOW MANY EQUATIONS? 15

# OF GROUPS? 4

# OF MEMBERS IN EACH GROUP? 5

MEMBERS IN ORDER
? EL DORADO
? BALTIMORE
? DAYTONA
? CARSON CITY
? ARKANSAS
? VICTORS
? TRIPLERS
? SUPERSTARS
? RAWHIDES
? UNDERDOGS
? 5T
? 4T
? 3T
? 2T
? 1T
? 5L
? 4L
? 3L
? 2L
? 1L

EL DORADO-SUPERSTARS-1T-3L-
BALTIMORE-VICTORS-3T-1L-
DAYTONA-RAWHIDES-4T-2L-
CARSON CITY-UNDERDOGS-2T-5L-
ARKANSAS-TRIPLERS-5T-4L-

READY
```

```
0001 PRINT "INSTRUCTIONS- TYPE IN YOUR E
QUATIONS IN"
0002 PRINT "DATA LINES 6000-6999.  WHEN T
HE COMPUTER"
0003 PRINT "ASKS FOR 'MEMBERS IN ORDER'(
LINE 40)"
0004 PRINT "YOU MUST TYPE IN THE MEMBERS
 GROUP BY"
0005 PRINT "GROUP.  ALSO, IF THE MEMBERS
OF A GROUP "
0006 PRINT "HAVE AN ASCENDING ORDER, YOU
 MUST TYPE"
0007 PRINT "THEM IN IN THAT ASCENDING OR
DER."
0008 DIM V(11),V1(11),G(12),D$(20),R(6),
R1(6)
0009  S=15626: I9=1
0010 READ W,W,W,W,W
0019 INPUT "HOW MANY EQUATIONS",P2
0020 INPUT "# OF GROUPS",N
0030 INPUT "# OF MEMBERS IN EACH GROUP",
A
0031  H=A
0040 PRINT "MEMBERS IN ORDER"
0050 FOR X=1 TON*A: INPUTD$(X):NEXTX
0100 FOR X=1 TO N*A
0110 POKE( S+X*20+X,3):IFX<=H THENGOSUB4
500
0120 NEXT X
0155 FOR R2=A-1 TO2 STEP -1
1005 READ C$,D$,F$
1010  K=0:Z=0:Z1=0
1019  P2=P2-1
1020 FOR X=1 TON*A
1022 IF C$=D$(X) THENZ=X
1024 IF F$=D$(X) THENZ1=X
1026 NEXT X
1027 IF Z1<>0 THENIFZ<>0 THEN1030
1028 PRINT "THERE IS A TYPING ERROR....S
MEWHERE!!!!":END
1030 IF D$="=" THENK=1:F=3:GUIU1100
1035 IF D$="<>"  THENF=2:GUIU1100
1038 IF D$="<" THENL$=F$:F$=C$:C$=L$:W=Z
:Z=Z1:Z1=W:W4=1:GOTO4700
1040 IF D$=">" THENW4=1:GOTO4700
1060 GOTO 1300
1070 GOTO 1200
1071 IF I9/3=INT(I9/3) THENGOSUB1500
1072  I9=I9+1:IFX7>N+A-INT(A/2) THENGOSU
B1400
1073 GOTO 3000
1076 IF W4=1 THEN4800
1077 GOTO 1060
1100 POKE( S+Z*20+Z1,F):IFF=3 THENIFZ<=H
 THENGOSUB4500
1110 POKE( S+Z1*20+Z,F):IF F=3 THENIF Z1
<=H THENGOSUB4500
1114 IF K=0 THENIFP2=0 THEN1060
1115 IF K=0 THEN1005
1120  L1=Z1:L=Z
1125  J8=1
1127 IF INT(Z/H)<>Z/H THENZ=Z+H
1128  W=INT(Z/H)
1129 GOTO 1135
1130  L1=L:L=Z1
1131 IF INT(Z1/H)<>Z1/H THENZ1=Z1+H
1132  W=INT(Z1/H)
1135  X=(N*A-((N-W)*A))-H
1136  X=X+1
1137 IF X>N*A THEN1175
1138 IF X>N*A-((N-W)*A) THEN1175
1139 IF X=L THEN1170
1140 POKE( S+L1*20+X,2)
1170 GOTO 1136
1175 IF J8=1 THENJ8=0:GOTO1130
1177 IF S4=P2 THEN1060
1178 GOTO 1005
1200 FOR X=1 TON*A
1206 RESTORE
1210 READ W
1211 IF W=0 THEN1290
1212  Y=(W-1)*A
1215  X1=0
1220  Y=Y+1
1230 IF Y>N*A-((N-W)*A) THEN1270
1240 IF PEEK(S+X*20+Y)=2 THENX1=X1+1
1245 IF PEEK(S+X*20+Y)>2 THEN1210
1260 GOTO 1220
1270 IF X1=A-1 THENQ=((W*A)-A)+1:Q1=W*A:
GOSUB1750
```

FOR TRS-80*

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ACORN

SYSTEM SAVERS

by Tom Stibolt

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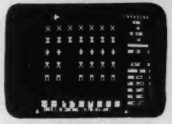

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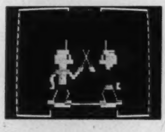

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634 North Carolina Avenue, S.E., Washington, D.C. 20003

Logic, cont'd...

```
1280 GOTO 1210
1290 NEXT X:GOTO1071
1300 FOR X=1 TO N*A
1310 FOR Y=1 TO N*A
1320 IF X=Y THEN1335
1329 IF PEEK(S+X*20+Y)=2 THENPOKE( S+Y*2
0+X,2)
1330 IF PEEK(S+X*20+Y)=3 THENGOSUB1350
1335 NEXT Y:NEXTX:GOTO1070
1350 FOR I=1 TON*A
1360 IF PEEK(S+20*X+I)=2 THENPOKE( S+20*
Y+I,2)
1365 IF PEEK(S+Y*20+I)=3 THEN1380
1370 IF PEEK(S+X*20+I)=3 THENPOKE( S+Y*2
0+I,3):IFY<=H THENGOSUB4500
1380 IF PEEK(S+Y*20+I)=2 THENPOKE( S+X*2
0+I,2)
1385 IF PEEK(S+X*20+I)=3 THEN1395
1390 IF PEEK(S+Y*20+I)=3 THENPOKE( S+X*2
0+I,3):IFX<=H THENGOSUB4500
1395 NEXT I:RETURN
1400 FOR X=1 TOA
1405  R1=0:R2=0:R3=0
1410  W6=0
1420 FOR Y=1 TO N*A
1430 IF PEEK(S+X*20+Y)=3 THENW6=W6+1:GOT
O1470
1435 NEXT Y
1440 IF W6=N THEN1479
1445 NEXT X
1450 RETURN
1470 IF Y<2*H+1 THENR1=Y:GOTO1435
1472 IF W6<2 THEN1445
1474 IF Y<3*H+1 THENR2=Y:GOTO1435
1476 IF W6<3 THEN1445
1478  R3=Y:GOTO1435
1479 IF R3=0 THENR3=R2
1480 POKE( S+X*20+X,4):POKE( S+X*20+R1,4
):POKE( S+X*20+R2,4)
1482 POKE( S+X*20+R3,4):POKE( S+R1*20+X,
4):POKE( S+R1*20+R1,4)
1485 POKE( S+R1*20+R2,4):POKE( S+R1*20+R
3,4):POKE( S+R2*20+X,4)
1488 POKE( S+R2*20+R1,4):POKE( S+R2*20+R
2,4):POKE( S+R2*20+R3,4)
1490 POKE( S+R3*20+X,4):POKE( S+20*R3+R1
,4):POKE( S+20*R3+R2,4)
1495 POKE( S+20*R3+R3,4)
1496 GOTO 1445
1500 FOR R2=A-1 TO2 STEP -1
1502 RESTORE
1504 READ W
1506 IF W=0 THEN1564
1507 IF W>A THEN1564
1508 FOR J8=(N-1)*A+1 TON*A-((N-W)*A)
1509  R1(1)=0:R1(2)=0:R1(3)=0:R1(4)=0:R1
(5)=0:R1(6)=0
1510  X=(N-1)*A+1
1511  R(1)=0:R(2)=0:R(3)=0:R(4)=0:R(5)=0
:R(6)=0

1516  C=0:L=0:K=1
1518 FOR R1=J8 TOX+A-1
1519 IF K>N THEN1563
1520  B=0:Y=(K-1)*A:R3=0
1524 IF Y+1=X THEN1556
1526  Y=Y+1:R3=R3+1
1528 IF R1>J8 THENIFY>(K-1)*A+A THENIFA-
B=R2 THEN1554
1530 IF R1>J8 THENIFY>(K-1)*A+A THEN1556

1531 IF Y>(K-1)*A+A THENIFA-B<>R2 THEN15
56
1532 IF Y>(K-1)*A+A THEN1554
1534 IF R1>J8 THEN1548
1536  R(R3)=PEEK(S+R1*20+Y):IFR(R3)>0 TH
ENL=1
1538  I=1
1540 IF R(R3)=2 THENB=B+1
1541 IF A-B=R2 THEN1554
1542 GOTO 1526
1544 IF A-B=R2 THEN1554
1546 GOTO 1556
1548  L1=(K-1)*A
1549 GOTO 3700
1552 GOTO 1526
1554  C=C+1:R1(1)=J8:R1(C)=R1
1556 IF A-B<>R2 THENIFR1=J8 THENR1=J8+A
1557 NEXT R1:K=K+1
1558  I=0
1560 IF C=R2 THENIFL=1 THEN1570
1561  C=0:L=0:GOTO1518
1563 NEXT J8:GOTO1504
1564 NEXT R2:GOTO1072
1566 NEXT X
1568 GOTO 1072
1570  Y=(K-2)*A+1
1572 FOR Z=X TOX+A-1
1574 IF R1(1)<>Z THENIFR1(2)<>Z THENIFR1
(3)<>Z THENIFR1(4)<>Z THEN1578
1576 NEXT Z:GOTO1564
1578 IF R1(5)<>Z THENIFR1(6)<>Z THEN1582

1580 GOTO 1576
1582 FOR X1=1 TOA
1590 IF R(X1)=0 THENPOKE( S+Z*20+(Y+X1-1
),2)
1592 NEXT X1:GOTO1580
1750 FOR W=Q TOQ1
1760 IF PEEK(S+X*20+W)>=2 THEN1780
1770 POKE( S+X*20+W,3):IFX<=H THENGOSUB4
500
1780 NEXT W
1790 RETURN
2000 FOR X=1 TOA
2010 PRINT ""
2020 FOR Y=1 TON*A
2050 IF PEEK(S+X*20+Y)>2 THEN2090
2060 NEXT Y:NEXTX:END
2090 REM
2100 PRINT D$(Y);"-";
2101 GOTO 2060
2116 POKE( S+X*20+L1,2)
3000 FOR X=1 TON*A
3010  X1=0
3020 FOR Y=1 TON*A
3060 IF PEEK(S+X*20+Y)=3 THEN3100
3070 NEXT Y:NEXTX:GOTO1076
3100  J8=X
3101 IF INT(X/H)<>(X/H) THENJ8=J8+H
3104 ON INT(J8/H)GOTO3200,3300,3400,3500
,3500
3110 FOR I=L TOL1
3120 IF I=X THEN3140
3130 POKE( S+I*20+Y,2)
3140 NEXT I
3145 GOTO 3070
3150 RETURN
3200  L=1:L1=A:GOTO3110
3300  L=A+1:L1=2*A:GOTO3110
3400  L=2*A+1:L1=3*A:GOTO3110
3500  L=3*A+1:L1=N*A:GOTO3110
3600 FOR Q=R3+1 TOA
3610  R(Q)=0:NEXTQ:RETURN
3700 FOR Q=1 TOA
3710  L1=L1+1
3720 IF R(Q)=2 THENIFPEEK(S+R1*20+L1)<>2
 THEN1556
3740 NEXT Q
3741 GOTO 1554
4500  X7=X7+1
4510 IF X7=N*A THEN2000
4520 RETURN
4700  U=U+1
4710 READ V(U),V1(U)
4720  G(U)=Z
4730  U=U+1
4740  G(U)=Z1
4750 IF S4=P2 THEN1060
4760 GOTO 1005
4800 FOR X=1 TOU STEP2
4830 FOR Y=(V(X)-1)*H+1 TOV(X)*H
4851 POKE( S+G(X)*20+((V(X)-1)*H)+1,2)
4852 POKE( S+G(X+1)*20+V(X)*H,2)
4853 POKE( S+G(X)*20+G(X+1),2)
4854 POKE( S+G(X+1)*20+G(X),2)
4855 IF V1(X)<=1 THEN4860
4856 FOR R1=1 TOV1(X)
4857 POKE( S+G(X)*20+((V(X)-1)*H+R1),2)
4858 POKE( S+G(X+1)*20+(V(X)*H)-R1,2)
4859 NEXT R1
4860 IF PEEK(S+G(X)*20+Y)>2 THENIFV1(X)>
0 THENGOSUB7000
4870 IF PEEK(S+G(X+1)*20+Y)>2 THENIFV1(X
)>0 THENGOSUB7010
4880 IF PEEK(S+G(X)*20+Y)>2 THENIFV1(X)=
0 THENGOSUB7020
4890 IF PEEK(S+G(X+1)*20+Y)>2 THENIFV1(X
)=0 THENGOSUB7080
4891 IF PEEK(S+G(X+1)*20+Y)=2 THEN8500
4892 IF PEEK(S+G(X)*20+Y)=2 THEN8600
4895 GOTO 8000
5990 DATA 1,2,3,4,0
6000 DATA BALTIMORE,>,RAWHIDES,3,1,RAWHI
DES,>,4L,3,1
6010 DATA DAYTONA,>,SUPERSTARS,4,0,ARKAN
SAS,<>,VICTORS
6020 DATA ARKANSAS,<>,RAWHIDES,1L,=,3T,S
UPERSTARS,>,5L,3,1
6030 DATA 5L,>,ARKANSAS,3,0,CARSON CITY,
<>,3L
6040 DATA UNDERDOGS,>,VICTORS,3,0
6050 DATA 5T,<>,5L,4T,<>,4L,3T,<>,3L,2T,
<>,2L,1T,<>,1L
7000 IF PEEK(S+G(X+1)*20+(Y-V1(X)))>2 TH
ENRETURN
7005 POKE( S+G(X+1)*20+(Y-V1(X)),3):IFG(
X+1)<=H THENGOSUB4500
7006 RETURN
7010 IF PEEK(S+G(X)*20+(Y+V1(X)))>2 THEN
RETURN
7015 POKE( S+G(X)*20+(Y+V1(X)),3):IFG(X)
<=H THENGOSUB4500:RETURN
7016 RETURN
7020 FOR J8=Y TOV(X)*H
7050 POKE( S+G(X+1)*20+J8,2)
7060 NEXT J8:RETURN
7080 FOR J8=(V(X)-1)*H+1 TOY
7110 POKE( S+G(X)*20+J8,2)
7120 NEXT J8:RETURN
8000 IF PEEK(S+G(X)*20+Y)=2 THENIF V1(X)
>0 THENIFY>(V(X)*H)+1 THEN9000
8010 IF PEEK(S+G(X+1)*20+Y)=2 THENIFV1(X
)>0 THENIFY<(V(X)*H)+1 THEN9010
8040 NEXT Y:NEXTX:GOTO1077
8500  W=(V(X)-1)*H
8510  W=W+1
8520 IF W>Y THENPOKE( S+G(X)*20+Y,2):POK
E( S+G(X)*20+(Y+1),2):GOTO4892
8530 IF PEEK(S+G(X+1)*20+W)<>2 THEN4892
8540 GOTO 8510
8600  W=Y
8610  W=W+1
8620 IF W>(V(X)*H) THENPOKE( S+G(X+1)*20
+Y,2):POKE( S+G(X+1)*20+(Y-1),2)
8625 IF W>(V(X)*H) THEN4995
8630 IF PEEK(S+G(X)*20+W)<>2 THEN4895
8640 GOTO 8610
9000 POKE( S+G(X+1)*20+(Y-V1(X)),2):GOTO
8040
9010 POKE( S+G(X)*20+(Y+V1(X)),2):GOTO80
40
```

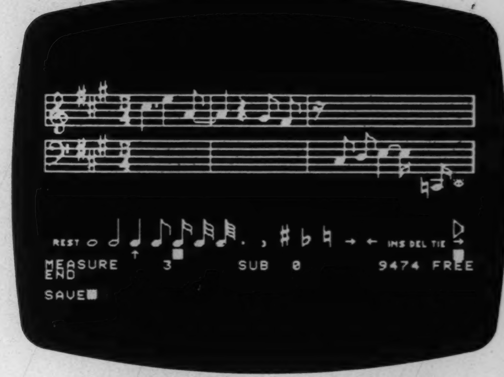
Interact Interactions

In response to my piece, "Where Are They Now", David Ross, president of Micro Video said, "here we are." Micro Video has taken over the manufacturing facilities and inventory of Interact Electronics and is continuing to market and support the unit. Not only that, but Micro Video has lowered the price of the basic computer to $375, and added an RS-232 interface and supporting software to the line as well as several new games.

They have located 3500 Interact owners and are providing support to them. However, they are still seeking the remaining 2000 or so Interact owners who did not have a warranty card on file with Interact. If you are one, or if you're interested in an inexpensive entry system, write Sue Denim, Micro Video, P.O. Box 7357, Ann Arbor, MI 48107.

(For a complete review of the Interact computer, see *Creative Computing*, December 1979, available for $2.50 postpaid.)—DHA

ALF/Apple Music Synthesizer



With the ALF software, entry of music is easy, fast and accurate.

The ALF Apple Music Synthesizer (AMS) is an easy to use peripheral which allows you to program music into an Apple II computer using standard musical notation. The ALF kit includes the synthesizer board (plugs into any peripheral slot), exceptional quality software, and an extensive user manual.

Sophisticated Music Entry Program

Sheet music is easily entered using the Apple game paddles. The high-resolution ENTRY program features the familiar music staff with a "menu" of musical items listed beneath it (note lengths, rests, edit commands, accidentals, etc.). One game paddle moves a cursor up and down the music staff and is used to select the note pitch; the second paddle chooses from the menu items (note length, etc.) With the ALF hi-res ENTRY program, you won't have to use cryptic codes to select note parameters.

As you program sheet music with ENTRY, measure bars are inserted automatically (and note values are tied over the bar where necessary). Key signatures are also automatic—you don't have to keep writing in every sharp or flat!

Three monophonic, individual parts can be programmed with each ALF Music Synthesizer. Two boards are required for stereo. A total of three synthesizers can be used simultaneously for a maximum of nine voices. By controling the envelope (or shape) of each voice, many different instrumental sounds can be simulated.

Eight-octave Range

The ALF Music Synthesizer has a pitch range of eight octaves—a wider range than a grand piano. The ALF can also play semitones—"blues notes" or the pitches in between the keyboard notes of a piano. (The pitch range is from 27.5 to 55,000 Hertz, well beyond the limits of human hearing.) Tuning accurancy is virtually perfect within two cents of pitch value.

Every parameter of the ENTRY program can be changed again and again during a musical piece. For example, you can make changes in key, time signature, volume, and timbre (envelope). Parts can be edited at any time, also. Notes can be added or deleted, note length can be changed, as well as pitch, volume, etc.

You can save songs on either cassette or disk, and play them back using either ENTRY or PLAY. The playback speed is adjusted with one of the game paddles, and can be varied during the playback, if you wish to change the overall tempo.

Colorful Playback Display

The ALF Music Synthesizer features a 16-color low-res graphic display during song playback. Each musical part is represented on a stylized piano "keyboard"—the intensity of the note determines the color, and the pitch is shown in relation to "middle C".

The ALF Music Synthesizer requires the use of an external audio amplifier. Stereo programming is possible with the use of two or three synthesizer boards.

The ALF software includes the ENTRY and PLAY programs, sample songs, an introduction to "envelope shaping", and demonstrations of advanced uses of the synthesizer.

Nine Voices for only $198

The new ALF "AM-II" music synthesizer offers an unbeatable value for the Apple owner who is a music hobbyist. With nine voices on a single music board for $198.00, the AM-II is the most economical device for creating music with the Apple.

The AM-II uses the same excellent ENTRY and PLAY programs as the more sophisticated ALF Music Synthesizer (AMS); the same hi-res graphic display from which notes are selected with the Apple game paddles (not typed with cryptic codes). All of the conveniences of the ENTRY program apply—easy editing, playback with low-res display, ability to save songs on cassette or disk, etc.

The AM-II has **stereo output** (3 voices in left, 3 voices in the middle, 3 voices in the right).

How can the AM-II offer so much for only $198.00? The two basic differences between the AM-II and the ALF Apple Music Synthesizer (AMS) are pitch accuracy and dynamic range. The AM-II has an accurate pitch range of about six octaves. Pitch values above the treble staff become increasingly inaccurate. Also, the AM-II has a dynamic range of 28db, with 16 different volume levels, (the AMS has a dynamic range of 78db).

The AM-II is manufactured with the same high quality standards as other products from the ALF Corporation. No sacrifice has been made in reliability; the new AM-II is simply a great bargain.

Professional musicians will still want to use the original Apple Music Synthesizer (AMS) for its extended range and volume controls (the AMS has a range of 8 octaves). But for the Apple owner who is interested in music as a hobby, the AM-II is the best music peripheral value available today.

Requires: 16K Apple II or Apple II Plus, cassette or Disk II, and an external audio amplifier (all necessary patch cords are included).

AM-II ALF/Apple Synthesizer	$198.00
AMS ALF/Apple Synthesizer	268.00

To order, send payment plus $3.00 shipping and handling to Peripherals Plus, 119 Maple Ave., Morristown, NJ 07960. Credit card customers should include card number and expiration date of Visa, MasterCard or American Express. Credit card customers may also order toll-free:

800-631-8112
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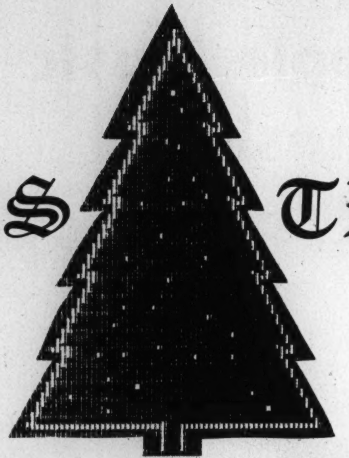
CHRISTMAS TREE



Stephen R. Berggren

One of the most enjoyable jobs of the Christmas season is decorating the Christmas tree. It is unfortunate that this pleasant and satisfying task can only be done once each year. Besides, how can you be any good at something you do only once a year? You should be able to decorate a Christmas tree whenever you want to. Can a personal computer solve a problem like this? Of course, it can! Using the *Christmas Tree* program you can decorate and display your own Christmas tree any time you want to.

The *Christmas Tree* program displays a Christmas tree and allows you to decorate it with up to 200 colored lights. Game paddles control the placement of the lights. The colors may be red, green, blue, violet or white. A delete function can be used to erase any mistakes. Once the tree is decorated to your satisfaction, it can be displayed with either flashing or non-flashing lights.

The program was written for the Apple II computer. The language used is Applesoft, the floating point version of Basic used in the Apple II. The program can operate under either the ROM or RAM versions of this language. However, under the RAM version, the number of lights used may be limited to about 150. Using any more lights may overwrite the graphics screen. Removing the REM statements will allow more lights to be used. The program makes use of the hi-resolution color graphics, game paddle inputs and shape table drawing routines of this system. Other systems with color graphics such as the Atari or the Compucolor should be able to run the program after changing the drawing and cursor routines. Of course, the data used to draw the tree must be modified to fit the different screen sizes.

The program itself is really very simple. Line 10 sets aside memory for the X and Y position and color of each light. The "%" sign means that they are integer values. After providing directions in lines 200 to 370, it uses lines 600 to 710 to draw the outline of a Christmas tree in green on the hi-resolution graphics screen. The data table at lines 150 and 160 provides the shape. Note that it draws the shape twice with the second shape right next to the first. This just makes a wider line. Next, a very simple shape table is put into the memory using data at line 840. This shape is a tiny square made up of four dots. This shape table is used to draw the lights and is also the cursor that shows where the lights will be placed. Its size is just large enough to show clearly on the screen. Now the program uses lines 1010 to 1060 to put a cursor on the screen in a place determined by the two paddle controls. The XDRAW commands at lines 1030 and 1050 reverse the colors of the background at that position. Since two reversals leave the screen looking just as it did, this procedure does not erase anything. The cursor may be moved anywhere without leaving a trail.

Once the tree is decorated to your satisfaction, it can be displayed with either flashing or non-flashing lights.

As the cursor is being drawn, the program uses line 1040 to see if a key has been pressed. If one has, lines 2040 to 2080 determine what key was pressed and branch to the needed routines. Line 2035 is simply a warning that all 200 lights have been put on the tree. Lines 2088 to 2130 put the light on the screen at the cursor position and put the position and color into memory. If a light is to be removed, the program jumps down to lines 6000 to 6030. This subroutine checks the position of the cursor square against the positions in memory. If it finds a match, it changes the color in memory to black and erases the light from the screen.

When the Christmas tree is finished, a "Control-N" key will send the program to lines 5000 to 5040. There the cursor square is removed and the program waits for a carriage return while the tree remains displayed. If a "Control-F" is typed instead, the program goes to lines 3000 to 4060. The cursor is first removed. Then a light is selected at random and turned on while another light is selected at random and turned off. This process is repeated very rapidly and gives the effect that the lights are flashing. The flashing continues until interrupted by a "Control-C" or "reset."

Several modifications to the program might be interesting. First, by saving the arrays that hold the light colors and positions a particularly pleasing tree might be kept indefinitely. Second, shape tables for stars, candy canes or bells could be included to allow for decorations besides lights. Finally, a means for drawing lines could be included to draw in background and unique decorations.

Decorating is part of the fun of the Christmas season. With this *Christmas Tree* program your computer can contribute to this fun by displaying a beautiful Christmas decoration designed by you. Merry Christmas! ☐

```
]RUN
    C H R I S T M A S   T R E E

         BY STEPHEN R BERGGREN

THIS PROGRAM ALLOWS YOU TO DECORATE
AND DISPLAY A CHRISTMAS TREE.  YOU MAY
PUT UP TO 200 LIGHTS ON THE TREE AND
MAKE THEM FLASH OR GLOW STEADILY.

TO PUT LIGHTS ON THE TREE, MOVE THE
FLASHING DOT TO THE RIGHT POSITION AND
PRESS A COLOR KEY.  WHEN FINISHED,
PRESS 'CTRL-F' FOR FLASHING LIGHTS OR
'CTRL-N' FOR NORMAL.  THESE ARE THE
AVAILABLE COLORS.  'DELETE' REMOVES
THE LIGHT UNDER THE CURSER.

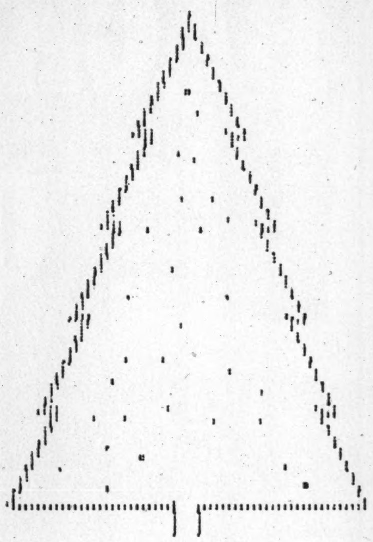
    W = WHITE        G = GREEN

    R = RED          V = VIOLET

    B = BLUE         D = DELETE

  (PRESS RETURN TO BEGIN)
```

Stephen R. Berggren, 2347 Duncan Drive, Dayton, Ohio 45324.



```
LIST

10  DIM XN%(200),YN%(200),CN%(200
     )
20  REM  XN%() = X POSITION OF LI
     GHT
30  REM  YN%() = Y POSITION OF LI
     GHT
40  REM  CN%() = COLOR OF LIGHT
140  REM  DATA TO DRAW TREE
150  DATA 180,124,180,70,148,86,1
     50,80,118,96,120,90,88,106,9
     0,100,58,116,60,110,28,126,2
     0,128
160  DATA 28,130,60,146,58,140,90
     ,156,88,150,120,166,118,160,
     150,176,148,170,180,186,180,
     132,190,132
200  HOME
210  PRINT "     C H R I S T M A
     S   T R E E"
220  PRINT : PRINT "         BY ST
     EPHEN R BERGGREN"
230  PRINT : PRINT "THIS PROGRAM
     ALLOWS YOU TO DECORATE"
240  PRINT "AND DISPLAY A CHRISTM
     AS TREE.  YOU MAY"
250  PRINT "PUT UP TO 200 LIGHTS
     ON THE TREE AND"
260  PRINT "MAKE THEM FLASH OR GL
     OW STEADILY."
270  PRINT : PRINT "TO PUT LIGHTS
      ON THE TREE, MOVE THE"
280  PRINT "FLASHING DOT TO THE R
     IGHT POSITION AND"
290  PRINT "PRESS A COLOR KEY.  W
     HEN FINISHED, "
300  PRINT "PRESS 'CTRL-F' FOR FL
     ASHING LIGHTS OR"
310  PRINT "'CTRL-N' FOR NORMAL.
      THESE ARE THE"
315  PRINT "AVAILABLE COLORS.  'D
     ELETE' REMOVES"
318  PRINT "THE LIGHT UNDER THE C
     URSER."
320  PRINT : PRINT "    W = WHIT
     E      G = GREEN"
330  PRINT : PRINT "    R = RED
            V = VIOLET"
340  PRINT : PRINT "    B = BLUE
            D = DELETE"
370  PRINT : INPUT "   (PRESS RET
     URN TO BEGIN)";A$
590  HGR2
595  REM  DRAW TREE
600  HCOLOR= 1
610  HPLOT 124,190 TO 124,180
620  FOR I = 1 TO 24
630  READ Y,X
640  HPLOT  TO X,Y
650  NEXT I
660  HPLOT 123,189 TO 123,178
670  RESTORE
680  FOR I = 1 TO 24
690  READ Y,X
700  HPLOT  TO X - 1,Y - 1
710  NEXT I
720  HCOLOR= 0
790  REM  LOAD THE SHAPE TABLE FO
     R THE LIGHTS
800  FOR I = 768 TO 774
810  READ SHAPE
820  POKE I,SHAPE
830  NEXT I
840  DATA   1,0,4,0,37,55,0
850  POKE 232,0: POKE 233,3
860  ROT= 0
870  SCALE= 1
880 N = 0
1000  REM  DRAW CURSOR DOT, LOOK
     FOR KEY INPUT
1010 XP = 256 -  PDL (0) + 15
1020 YP =  PDL (1): IF YP > 189 THEN
     YP = 189
1030  XDRAW 1 AT XP,YP
1040 KEY =  PEEK ( - 16383): IF K
     EY > 127 THEN 2000
1050  XDRAW 1 AT XP,YP
1060  GOTO 1010
1990  REM  TEST THE KEY INPUT
2000  POKE  - 16368,0
2010  IF KEY = 142 THEN 5000
2020  IF KEY = 134 THEN 3000
2030  IF KEY = 196 THEN  GOSUB 60
     00: GOTO 1050
2035  IF N = 200 THEN  PRINT  CHR$
     (7) CHR$ (7) CHR$ (7): GOTO
     1050
2040  IF KEY = 215 THEN CN%(N) =
     3: GOTO 2090
2050  IF KEY = 194 THEN CN%(N) =
     6: GOTO 2090
2060  IF KEY = 214 THEN CN%(N) =
     2: GOTO 2090
2070  IF KEY = 210 THEN CN%(N) =
     5: GOTO 2090
2080  IF KEY = 199 THEN CN%(N) =
     1: GOTO 2090
2085  GOTO 1050
2088  REM  DRAW A NEW LIGHT
2090  HCOLOR= CN%(N)
2100  DRAW 1 AT XP,YP
2110 XN%(N) = XP:YN%(N) = YP
2120 N = N + 1
2130  GOTO 1010
2990  REM  REMOVE THE CURSOR DOT
3000  HCOLOR= 0
3010  DRAW 1 AT XP,YP
3990  REM  FLASH THE LIGHTS BY RA
     NDOMLY TURNING ONE ON AND ON
     E OFF
4000 P =  INT ( RND (1) * N)
4010  HCOLOR= CN%(P)
4020  DRAW 1 AT XN%(P),YN%(P)
4025 P =  RND (1)
4030 P =  INT ( RND (1) * N)
4040  HCOLOR= 0
4050  DRAW 1 AT XN%(P),YN%(P)
4060  GOTO 4000
4990  REM  REMOVE THE CURSOR DOT
     AND QUIT WITH ALL LIGHTS ON
5000  HCOLOR= 0
5010  DRAW 1 AT XP,YP
5020  INPUT A$
5030  TEXT
5040  END
5990  REM  ERASE THE DOT UNDER TH
     E CURSOR
6000  FOR I = 0 TO N
6010  IF XP = XN%(I) AND YP = YN%
     (I) THEN  HCOLOR= 3:CN%(I) =
     0: DRAW 1 AT XP,YP: PRINT  CHR$
     (7)
6020  NEXT I
6030  RETURN
```

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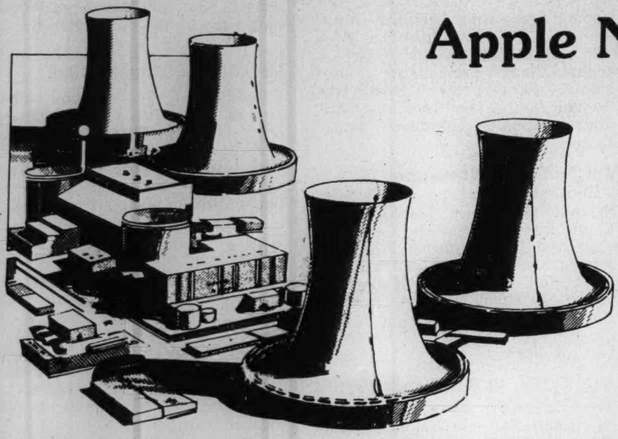
Apple Nuclear Power Plant



Stephen R. Berggren

The political implications of personal computers are only gradually becoming clear. By trying to run a nuclear power plant, for example, you get a better feel for the risks involved . . .

The safety, usefulness and desirability of nuclear power plants is a subject that has recently been a very "hot" topic of conversation. It seems that almost everyone has an opinion about what should be done about nuclear power plants. It's too bad that only a very few people have actually been at the controls of one of the big generating plants to get a firsthand feel for how it works.

That's all I wanted to do; to run my own nuclear power plant. Unfortunately, I did not have several hundred million dollars or a license from the Nuclear Regulatory Commission. Neither did I want to wait the ten years it would take to build a power plant. I was therefore forced to use what I did have, my Apple II computer. This wasn't such a bad alternative. After all, on a computer the worst thing that could result from my mismanagement would be a software crash. I would be completely safe from explosions, radiation and irate protesters.

My efforts at a safe study of nuclear power have resulted in a program that simulates the performance of a pressurized water nuclear power plant. The program is designed to be educational, as well as challenging and fun. It starts with a simple description of the workings of a plant I designed. This is followed by an animated diagram of the plant and its operation in color graphics. Then instructions are provided on how to operate the controls. Finally the plant starts operation with a daily status report appearing on the screen. The keyboard is used to adjust the controls and then move to the next day. Within the program, a series of equations simulates the response of the reactor and power system and presents the next day's status. Warnings are provided when the plant is not operating properly or when any damage is done. This report is a much simplified version of the computerized status reporting used in most nuclear power plants.

I did not have several hundred million dollars or a license from the Nuclear Regulatory Commission. I was therefore forced to use what I did have, my Apple II computer.

As with a real power plant, the object is to produce as much electrical power as possible without injuring anyone or damaging the equipment. This plant can produce up to two megawatts of power before overloading, but the average power output depends on how close to this maximum the plant is operated and how long the plant is down for maintenance. When the plant's nuclear fuel is exhausted (after about 120 days) the program evaluates the operator's performance based on the average power output and the damage sustained by the plant. Of course, if the plant's operation should result in a meltdown, the operator should consider his performance rather poor.

A Disastrous Sample Run

In the sample program run, you can see that at day one the plant was in cold shutdown and everything was at 25 (degrees centigrade). Of course, the control rods were fully inserted and all coolant flow was stopped. I started the plant by pulling out the control rods. As the reactor heat went up, primary and secondary coolant flow was started to cool the reactor and run the generator turbine. By day 15, the plant's temperatures had settled down and the plant was running well, although not very close to its maximum power output. That's the trick; keeping the power output high and the temperatures in the operating ranges.

At day 19, a small coolant leak developed, but I decided not to shut down just to fix it. However, by day 23 things had really turned sour, and I had to try for a maintenance shutdown. With all coolant systems on full and the control rods in, the reactor cooled quickly and then entered the automatic maintenance shutdown mode. It took 32 days to repair the damage but then the plant was ready to start again. But I made a mistake. I tried to heat the reactor too quickly and went beyond the safe temperature range. Then, I tried to compensate by increasing the primary coolant flow and got into more trouble. Before I could get the emergency coolant on, the reactor went out of control and disaster struck. Too bad, but I deserved it. At least no one was hurt.

The program is written in a very straightforward manner and only the keyboard input and operating algorithms should be at all hard to understand. Lines 955 to 985 demonstrate the keyboard input. The key is entered as A$ and filtered in line 965 to allow only (space), (return) and 0 thru 9 to pass through. The (space) will skip to the next variable while the (return) will allow the program to continue to the next day's report. A$ is then concatenated to B$ whose VAL becomes the new input variable. The FOR statement in line 955 limits the input to four keystrokes. The program is almost entirely crashproof. *(Famous last words.—Ed.)*

If you are really interested in the operating algorithm, lines 1280 to 1395 simulate heat flow equations that have been simplified slightly. Don't feel too bad if you don't understand exactly how they work. They do work. The REM statements

---

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GAME PACKAGE #1

HOSTAGE Negotiate and/or attack in this contest between the Authorities and the Terrorists. Terrorists select their target; choosing to seize Hostages at Foreign Embassies, the U.N. Building, Airliners, Hospitals, School Buses, or even Nuclear reactors. During play, Terrorists and Authorities have ample opportunity to bargain and double-cross each other. As in real life, public opinion counts and shapes the player's actions. Players have a dramatic and realistically wide range of tactical options. This game accurately reflects the intricacies of threat, promise, and all facets of negotiation.

BLACK GOLD Strike oil and build your own petroleum empire in this exciting simulation. Players strive to dominate the oil market. Options must be bought, wells drilled, and marketing strategies chosen. Players face a host of problems in this simulation. These range from uncertain geological and price conditions to labor strikes, the impact of natural disasters, and perhaps most troublesome, the demands of El Supremo, a greedy oil potentate and ruler of some of the best territory for oil exploration.

PRIMARY FIGHT A Political-Math game in which up to 6 players compete for the nomination of their party. Results depend upon campaign strategy and mathematical skill.

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GAME PACKAGE #3

PRIME TIME Players compete as network executives. Each selects T.V. Shows for competing time slots. Choose from a wide range of programs including sit-coms, dramas, soaps, westerns, sci-fi, news and documentary shows, etc. Up to three players compete for ratings and advertising revenue. Program simulates fan loyalties and industry events including FCC rulings and criticism from various civic groups. Exciting and realistic.

STAR CLIPPER Sophisticated interplanetary trading game. Profit from technical change and discovery, exploit planetary scarcities, shape your buying and selling strategies as new planets are discovered and opportunities revealed. You must strive to avoid space-time warps and a host of lesser dangers as you ply the galactic trade routes. Players (up to 6) must navigate and trade as prices change and obstacles are met. Beware the space pirates!

BULLS AND BEARS Financial investment game for up to six players. Make a fortune by correctly using news bulletins and rumors central to this fast moving game. Stocks range from the speculative and highly volatile to the more staid. The Wall Street Bulletin reports run the gamut from general economic trends to new technology, discoveries, disasters and even the doings of the Ayatollah.

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TIME TRAVELER

The best of the adventure games. Confronts player with complex decision situations and the demand for real time action. Using the Time Machine, players must face a challenging series of enviornments that include; the Athens of Pericles, Imperial Rome, Nebuchanezzar's Babylon, Ikhaton's Egypt, Jerusalem at the time of the crucifixion, The Crusades, Machiavelli's Italy, the French Revolution, the American Revolution, and the English Civil War. Deal with Hitler s Third Reich, Vikings, etc. At the start of each game players may choose a level of difficulty . . . the more difficult, the greater the time pressure. To suceed you must build alliances and struggle with the ruling powers. Each game is unique. $24.95

SUPER STAR BASEBALL

ALL TIME SUPER STAR BASEBALL Sample Lineup		SUPER STAR BASEBALL Sample Lineup	
B. Ruth	T. Williams	D. Parker	J. Rice
L. Gehrig	J. Foxx	W.Stargell	H. Aaron
J. DiMaggio	H. Greenberg	W. Mays	L. Brock
J. Jackson	R. Hornsby	P. Rose	R. Carew
G. Sisler	H. Wilson	O. Cepeda	H. Killebrew
S. Musial	B. Terry	C. Yazstremski	R. allen
T. Cobb	M. Mantle	W. McCovey	R. Leflore
W. Mays	H. Aaron	R. Jackson	R. Zisk
C. Young-P	W. Johnson-P	G. Brett	B. Madlock
		R. Guidry-P	T. Seaver-P

Performance is based on the interaction of actual batting and pitching data. Game can be played by one or two players with the computer acting as a second player when desired. Players select rosters and lineups and excersize strategic choices including hit and run, base stealing, pinch hitting, intentional walk, etc. Highly realistic, there are two versions, ALL TIME SUPER STAR BASE—BALL, and SUPER STAR BASEBALL featuring players of the current decade. Each includes about 50 players allowing nearly infinite number of roster and lineup possibilities.

$14.95

SWORD OF ZEDEK

Fight to overthrow Ra, The Master of Evil. In this incredible adventure game, you must confront a host of creatures, natural and supernatural. To liberate the Kingdom, alliances must be forged and treasures sought. Treachery, deceit and witchcraft must be faced in your struggles as you encounter wolves, dwarves, elves, dragons, bears, owls, orcs, giant bats, trolls, etc. Each of the 12 treasures will enhance your power, by making invisible, invulnable, more eloquent, more skillful in combat etc., etc., as you explore the realms of geography, both on the surface and underground. Dungeons, temples, castles, mountains etc., are all a part of the fantastic world of Ra. Each game is unique in this spectacular and complex world of fantasy. $24.95

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All programs require 16K● TRS-80 programs require Level II BASIC● Apple programs require Applesoft BASIC

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at the end of the program give the prefixes and suffixes used to create the variables. They also describe what each section is supposed to do.

Program Details

The program is written in Applesoft, Apple's floating point Basic, and fits in a 16K memory. Translation should be very easy with some exceptions. The diagram routines use color graphics. If your system does not have graphics, delete lines 6000 to 7060. You must also fix lines 220 and 222, since calling a deleted subroutine is an easy way to crash. The program also makes extensive use of logic evaluations within expressions. For example, (A 100) equals one if true, and zero if false. This is a quick and easy way to avoid IF statements. If your system does not have this capability, convert each of these expressions to IF statements. Many of the variables have percent signs following them. This is Applesoft's way of saying 'integer variable.' I used them to keep fractions out of the numbers printed in the status report. If your system can easily control the number of decimal places printed, forget the percent signs.

Before I could get the emergency coolant on, the reactor went out of control and disaster struck. Too bad, but I deserved it.

In Applesoft, the PEEK in line 910 returns the vertical position of the cursor. If you can't find your cursor, you will have to think up another way to input the control variable. Finally, the instructions and the status report are made to fit a 40 by 24 character screen. These can be easily modified to fill a wider screen.

I have some final words to engineers, nuclear technicians and other qualified readers. No, I have never seen a real power plant that was designed like this. Yes, I know it takes much less than a day for a reactor to respond to changes in coolant flow and control rod position. Besides, who ever heard of a reactor with only one emergency cooling system, and that one with a limited supply of coolant? And, blasphemy of blasphemies, no SCRAM mechanism? I am sure your list of discrepancies is far more complete. What I have tried to do is to incorporate characteristics and responses of a simplified and idealized nuclear power plant into a computer simulation game. Several concessions to accuracy were made in order to create a simulation that would provide realistic responses to simple inputs and make an interesting and instructive game. □

```
10  HOME
20  PRINT  SPC( 8)"APPLE NUCLEAR POWER PLANT"
30  PRINT  SPC( 9)"BY STEPHEN R. BERGGREN
40  PRINT
50  PRINT "THIS PROGRAM SIMULATES THE OPERATION OF"
60  PRINT "A NUCLEAR POWER REACTOR.  THE OBJECT"
70  PRINT "IS TO OPERATE THE PLANT AT A MAXIMUM"
80  PRINT "AVERAGE POWER OUTPUT WITHOUT CAUSING"
90  PRINT "A REACTOR MELTDOWN."
100  PRINT
110  PRINT "THE CONTROL RODS ADJUST THE AMOUNT OF"
120  PRINT "HEAT PRODUCED BY THE REACTOR.  PRIMARY"
130  PRINT "COOLANT TRANSFERS THIS HEAT TO THE HEAT"
140  PRINT "EXCHANGER.  SECONDARY COOLANT TRANSFERS"
150  PRINT "HEAT FROM THE HEAT EXCHANGER TO THE"
160  PRINT "TURBINE, WHERE POWER IS PRODUCED, AND"
170  PRINT "FINALLY TO THE COOLING TOWER.  THE"
180  PRINT "EMERGENCY COOLANT IS USED TO HELP SHUT"
190  PRINT "DOWN THE REACTOR WHEN OTHER SYSTEMS"
200  PRINT "FAIL.  UNLIKE THE OTHER COOLANTS, "
210  PRINT "EMERGENCY COOLANT IS NOT RECYCLED."
220  PRINT : INPUT "ENTER 'D' TO SEE REACTOR DIAGRAM    ENTER 'I' FOR WORKIN
G INSTRUCTIONS       ENTER 'S' TO START OPERATION     ";A$
221  IF A$ = "D" THEN  GOSUB 6000: GOTO 220
222  IF A$ = "S" THEN 390
225  TEXT : HOME
230  PRINT "THE CONTROLS ARE OPERATED BY TYPING IN"
235  PRINT "THE DESIRED CONTROL ROD SETTING AND"
240  PRINT "FLOW RATES.(USE VALUES FROM 0 TO 100)"
245  PRINT "IF NO ENTRY IS MADE, THE VALUES WILL"
250  PRINT "NOT CHANGE.  USE THE SPACE BAR TO STEP"
255  PRINT "TO THE DIFFERENT FUNCTIONS.  WHEN THE"
260  PRINT "DESIRED ENTRIES HAVE BEEN MADE, USE THE"
265  PRINT "'RETURN' KEY TO ADVANCE TO THE NEXT DAY."
270  PRINT "THE REACTOR CAN BE OPERATED UNTIL A"
275  PRINT "MELTDOWN OCCURS OR THE REACTOR FUEL IS"
280  PRINT "EXHAUSTED.  THE FUEL WILL LAST FOR"
285  PRINT "ABOUT 100 TO 150 DAYS.  WHEN THE FUEL"
290  PRINT "IS EXHAUSTED, YOUR PERFORMANCE WILL BE"
295  PRINT "EVALUATED.
298  PRINT : INPUT "    (PRESS RETURN TO CONTINUE)";A$: HOME
300  PRINT : PRINT "IF YOU WANT TO REPAIR DAMAGE OR REPLACE"
305  PRINT "COOLANT, BRING THE REACTOR TEMPERATURE"
310  PRINT "DOWN BELOW 100 AND SHUT OFF THE COOLANT"
315  PRINT "FLOWS.  THIS WILL CAUSE AN AUTOMATIC"
320  PRINT "MAINTENANCE SHUTDOWN AND ALL COOLANT"
325  PRINT "WILL BE REPLENISHED AND REPAIRS MADE."
330  PRINT "THE GREATER THE DAMAGE, THE LONGER THE"
335  PRINT "REPAIRS WILL TAKE."
340  PRINT
350  PRINT "      WARNING: THIS POWER PLANT HAS"
360  PRINT "      NO AUTOMATIC SAFETY DEVICES!!"
370  PRINT
380  GOTO 220
390  REM  INITIATE
400  ~~GOSUB 2000~~
410 RH = 0
420 RL = 0
430 DAY% = 0
440 TT = 0
450 DMGE% = 0
455 A% = 0:A1% = 0:A2% = 0
460  REM WRITE REPORT
470  TEXT : HOME
475 DAY% = DAY% + 1
480  PRINT  SPC( 7)"APPLE NUCLEAR POWER PLANT"
490  PRINT  SPC( 8)"STATUS REPORT - DAY ";DAY%
500  PRINT
510  PRINT "WARNINGS:"
520  IF RT% > 800 THEN  PRINT " REACTOR OVERHEATED":RD% = RD% + 1 + (RT%
      > 850) + (RT% > 900) + 2 * (RT% > 950):PD% = PD% + 1:ED% = ED% + 1
      + (RT% > 850)
530  IF XT% > 500 THEN  PRINT " HEAT EXCHANGER OVERHEATED":XD% = XD% + 1
      + (XT% > 600):PD% = PD% + 1:SD% = SD% + 1
540  IF GO% > 2000 THEN  PRINT " TURBINE OVERLOADED":TD% = TD% + 1 + (GO%
      > 2500  ):SD% = SD% + 1
550  IF CT% > 300 THEN  PRINT " COOLING TOWER OVERHEATED":SD% = SD% + 1
560  IF GO% < 1000 THEN  PRINT " POWER OUTPUT LOW"
570  IF EV% < 200 THEN  PRINT " EMERGENCY COOLANT LOW"
580  IF PV% < 100 THEN  PRINT " PRIMARY COOLANT LOW":PD% = PD% + 1
590  IF SV% < 100 THEN  PRINT " SECONDARY COOLANT LOW":SD% = SD% + 1
600  PRINT
610  PRINT "DAMAGE:"
620  IF RD% > 3 THEN  PRINT " REACTOR CORE DAMAGED"
630  IF PD% > 4 THEN  PRINT " PRIMARY COOLANT LEAK - ";PD%;"/DAY":PV% =
      (PV% - P
D%) * ((PV% - PD%) > 0)
640  IF SD% > 4 THEN  PRINT " SECONDARY COOLANT LEAK - ";SD%;"/DAY":SV% =
```

Economic and Ecology Simulations

The Ecology Simulations series are a unique educational tool. They are based on "simulation models" developed by the Huntington Two Computer Project at the State University of New York at Stony Brook under the direction of Dr. Ludwig Braun. The programs and accompanying documentation are written for self-teaching or classroom use and include background material, sample exercises and study guides. Graphic displays were specially developed by Jo Ann Comito at SUNY and Ann Corrigan at Creative Computing. The Ecology Simulations packages are a remarkable educational application of micro-computers.

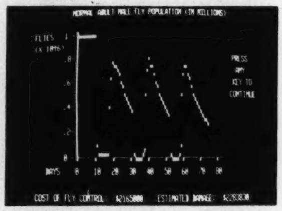
Ecology Simulations-1, CS-3201 (16K)

1. Pop

The POP series of models examines three different methods of population projection, including exponential, S-shaped or logistical, and logistical with low density effects. At the same time the programs introduce the concept of successive refinement of a model, since each POP model adds more details than the previous one.

2. Sterl

STERL allows you to investigate the effectiveness of two different methods of pest control—the use of pesticides and the release of sterile males into the fly population. The concept of a more environmentally sound approach versus traditional chemical methods is introduced. In addition, STERL demonstrates the effectiveness of an integrated approach over either alternative by itself.



PRESS ANY KEY TO CONTINUE

COST OF FLY CONTROL: $216500 ESTIMATED DAMAGE: $2283030

3. Tag

TAG simulates the tagging and recovery method that is used by scientists to estimate animal populations. You attempt to estimate the bass population in a warm-water, bass-bluegill farm pond. Tagged fish are released in the pond and samples are recovered at timed intervals. By presenting a detailed simulation of real sampling by "tagging and recovery," TAG helps you to understand this process.

4. Buffalo

BUFFALO simulates the yearly cycle of buffalo population growth and decline, and allows you to investigate the effects of different herd management policies. Simulations such as BUFFALO allow you to explore "What if" questions and experiment with approaches that might be disastrous in real life.

Ordering Information

The series is designed for the 16K TRS-80 Level II and is attractively packaged in a vinyl binder with a complete study guide. *Ecology Simulations-I:* disk CS-3501, cassette 3201. *Ecology Simulations-II:* disk CS-3502, cassette CS-3204. *Social and Economic Simulations:* disk CS-3508, cassette CS-3204. At a modest $24.95 each, the series is an affordable necessity.

To order, send payment plus $1.00 shipping and handling to Creative Computing Software, Dept. ACGG, P.O. Box 789-M, Morristown, NJ 07960. For Faster Service, call in your order toll-free to our order hotline 800-631-8112. In NJ call 201-540-0445.

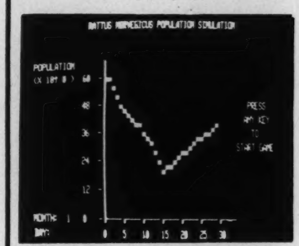
Ecology Simulations-2, CS-3202 (16K)

1. Pollute

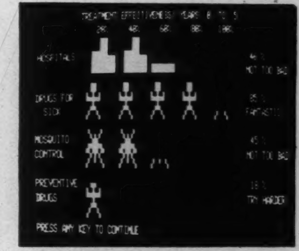
POLLUTE focuses on one part of the water pollution problem; the accumulation of certain waste materials in waterways and their effect on dissolved oxygen levels in the water. You can use the computer to investigate the effects of different variables such as the body of water, temperature, and the rate of dumping waste material. Various types of primary and secondary waste treatment, as well as the impact of scientific and economic decisions can be examined.

2. Rats

In RATS, you play the role of a Health Department official devising an effective, practical plant to control rats. The plan may combine the use of sanitation and slow kill and quick kill poisons to eliminate a rat population. It is also possible to change the initial population size, growth rate, and whether the simulation will take place in an apartment building or an entire city.



PRESS ANY KEY TO START GAME



PRESS ANY KEY TO CONTINUE

3. Malaria

With MALARIA, you are a Health Official trying to control a malaria epidemic while taking into account financial considerations in setting up a program. The budgeted use of field hospitals, drugs for the ill, three types of pesticides, and preventative medication, must be properly combined for an effective control program.

4. Diet

DIET is designed to explore the effect of four basic substances, protein, lipids, calories and carbohydrates, on your diet. You enter a list of the types and amounts of food eaten in a typical day, as well as your age, weight, sex, health and a physical activity factor. DIET is particularly valuable in indicating how a diet can be changed to raise or lower body weights and provide proper nutrition.

Social and Economic Simulations CS-3204 (16K)

1. Limits

LIMITS is a micro-computer version of the well known "Limits to Growth" project done at MIT. It contains a model of the world that is built of five subsystems (population, pollution, food supply, industrial output, and resource usage) linked together by six variables: birth rate, death rate, pollution generation, resource usage rate, industrial output growth rate, and food production rate.

2. Market

Market allows two or more people to play the roles of companies who are competing for the market for a particular product: in this case, bicycles.

Each player makes marketing decisions quarterly including the production level, the advertising budget, and the unit price of the product for his/her company.

3. USPop

USPOP allows the user to study many aspects of the United States' human demography (population change) including population growth, age and sex distribution. USPOP makes population projections and investigates the consequences of many different demographic changes.

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Power Plant cont'd...

```
     (SV% -  SD%) * ((SV% - SD%) > 0)
650  IF ED% > 2 THEN  PRINT " EMERGENCY COOLANT LEAK - ";2 * ED%;"/DAY":
     EV% = (E V% - 2 * ED%) * ((EV% - 2 * ED%) > 0)
660  IF PB% THEN  PRINT " PRIMARY COOLANT PUMP FAILURE - ";10 * PD% *
     (PD% < 10)  + 100 * (PD% >  = 10);"%"
670  IF SB% THEN  PRINT " SECONDARY COOLANT PUMP FAILURE - ";10 * SD% *
     (SD% < 1  0) + 100 * (SD% >  = 10);"%"
680  IF XB% THEN  PRINT " HEAT EXCHANGER FAILURE"
690  IF GB% THEN  PRINT " TURBINE FAILURE"
700  PRINT
710  IF RD% > 5 THEN  PRINT "     MELTDOWN!  MELTDOWN!  MELTDOWN!":
     GOTO 3000
720  PRINT "INDICATORS:"
730  PRINT " REACTOR TEMP. (MAX 800) ";RT%
740  PRINT " HEAT EXCHANGER TEMP. (MAX 500) ";XT%
750  PRINT " COOLING TOWER TEMP. (MAX 300) ";CT%
760  PRINT " POWER OUTPUT (MAX 2000KW) ";GO%;"KW"
765 KW% = TT / DAY%
770  PRINT " AVERAGE POWER OUTPUT  ";KW%;"KW/DAY
800  PRINT " CONTROL RODS- ";A%
810  PRINT " COOLANTS"
820  PRINT "  EMERGENCY  LEVEL- ";EV%;"  FLOW- ";EF%
830  PRINT "  PRIMARY    LEVEL- ";PV%;"  FLOW- "PF%
840  PRINT "  SECONDARY  LEVEL- ";SV%;"  FLOW- "SF%;
850  IF (100 - RL) < 5 THEN  PRINT : PRINT : PRINT "REACTOR FUEL
     EXHAUSTED": GOT O 4000
900  REM GET NEW CONTROL VALUES
910 P =  PEEK (37)
920  VTAB (P - 3)
930  HTAB (20)
950 A2% = A1%:A1% = A%
955 B$ = "": FOR I = 1 TO 4
960  GET A$:Z =  ASC (A$)
965  IF (Z <  > 13 AND Z <  > 32) AND (Z > 57 OR Z < 48) THEN 960
970 B$ = B$ + A$: IF Z = 13 THEN 1170
975  IF Z = 32 THEN 990
980 A% =  VAL (B$):A% = A% + (100 - A%) * (A% > 100)
985  PRINT A$;: NEXT I
990  VTAB (P - 1)
1000  HTAB (35)
1005 B$ = "": FOR I = 1 TO 4
1010  GET A$:Z =  ASC (A$)
1015  IF (Z <  > 13 AND Z <  > 32) AND (Z > 57 OR Z < 48) THEN 1010
1020 B$ = B$ + A$: IF Z = 13 THEN 1170
1025  IF Z = 32 THEN 1050
1030 EF% =  VAL (B$):EF% = EF% + (100 - EF%) * (EF% > 100)
1035  IF EF% > EV% THEN EF% = EV%
1040  PRINT A$;: NEXT I
1050  VTAB (P)
1060  HTAB (35)
1065 B$ = "": FOR I = 1 TO 4
1070  GET A$:Z =  ASC (A$)
1075  IF (Z <  > 13 AND Z <  > 32) AND (Z > 57 OR Z < 48) THEN 1070
1080 B$ = B$ + A$: IF Z = 13 THEN 1170
1085  IF Z = 32 THEN 1110
1090 PF% =  VAL (B$):PF% = PF% + (100 - PF%) * (PF% > 100)
1100  PRINT A$;: NEXT I
1110  VTAB (P + 1)
1120  HTAB (35)
1125 B$ = "": FOR I = 1 TO 4
1130  GET A$:Z =  ASC (A$)
1135  IF (Z <  > 13 AND Z <  > 32) AND (Z > 57 OR Z < 48) THEN 1130
1140 B$ = B$ + A$: IF Z = 13 THEN 1170
1145  IF Z = 32 THEN 1165
1150 SF% =  VAL (B$):SF% = SF% + (100 - SF%) * (SF% > 100)
1160  PRINT A$;: NEXT I
1165  HTAB (1): VTAB (P - 3): CALL  - 958: GOTO 800
1170  IF PF% = 0 AND SF% = 0 AND RH < 1 AND RT% < 100 AND A% = 0 THEN
      GOSUB 200 0: HTAB (1): VTAB (24): CALL  - 922: PRINT "
      MAINTENANCE SHUTDOWN - ";MD%;" DAYS": FOR I = 0 TO 5000: NEXT
1180  IF EF% > EV% THEN EF% = EV%
1200  REM DAMAGE ASSESSMENT AND OPERATION CALCULATIONS
1205 EV% = EV% - EF% - 2 * ED% * (ED% > 3)
1210 PD% = PD% + (PF% > 90) * ( RND (20) > .95)
1220 SD% = SD% + (SF% > 90) * ( RND (20) > .92)
1230 PB% = PD% > 5
1240 SB% = SD% > 5
1250  IF PF% > (100 - PD% * 10) AND PB% THEN PF% = (100 - PD% * 10) *
      (100 - PD%  * 10 > 0)
1260  IF SF% > (100 - SD% * 10) AND SB% THEN SF% = (100 - SD% * 10) *
      (100 - SD%  * 10 > 0)
1270 RL = RL + RH / 50
1280 RH = (A% * 30 + A1% * 60 + A2% * 10) / 2500 * (100 - RL)
1300 PH = PF% * (100 * (PV% > 100) + PV% * (PV% <  = 100)) / 350
1310 EH = EF% / 200 * (RT% - 25)
1320 RT% = RT% + RH - EH - PH - 5 * (RT% > 25)
1325 RT% = 25 + (RT% - 25) * (RT% > 25)
1330 XT% = ((RT% - 25) * PF% + (CT% - 25) * SF%) / (PF% + SF% + 1) + 25
```

```
1340  IF XB% THEN XT% = RT% * .8 + 5
1350 SH = SF% * (100 * (PV% > 100) + PV% * (PV% <  = 100)) / 350 *
     (XT% - CT%)
1360  IF XB% THEN SH = SH * .2
1370 GO% = SH / XT% * (XT% - CT%) * 2 / 3
1375  IF GO% > 2600 THEN GO% = 2600
1380 GO% = GO% * (GO% > 0) * (GB% = 0)
1390 CT% = 25 + ((XT% - 25) * (SH - GO%) / (SH + 1) * .75)
1395 CT% = 25 * (CT% <  = 25) + CT% * (CT% > 25)
1400  IF XB% < 1 THEN XB% = (XD% > 2) * ( RND (4) > .9)
1410  IF GB% < 1 THEN GB% = (GD% > 4) * ( RND (4) > .9)
1420 TT = TT + GO%
1430  GOTO 470
2000  REM MAINTENANCE REPAIR SUBROUTINE
2010 EV% = 300
~~2020 PV% = 120~~
2030 SV% = 120
2040 RT% = 25
2050 XT% = 25
2060 CT% = 25
2070 DMGE% = DMGE% + 2 * RD% + ED% + PD% + XD% + SD% + GD%
2080 MD% = 5 + 3 * (10 * (RD% > 3) + (ED% > 3) + (PD% > 3) + (SD% > 3)
     + 2 * PB%  + 2 * SB% + 3 * XB% + 3 * GB%):DAY% = DAY% + MD%
2090 RD% = 0
2100 ED% = 0
2110 PD% = 0
2120 XD% = 0
2130 SD% = 0
2140 GD% = 0
2150 PB% = 0
2160 SB% = 0
2170 XB% = 0
2180 GB% = 0
2190 EF% = 0:PF% = 0:SF% = 0
2195 GO% = 0
2200  RETURN
3000  REM  MELTDOWN ENDING
3010  PRINT
3020  IF RD% > 6 THEN 3100
3030  PRINT "THE REACTOR CORE HAS BEEN DISTROYED BY"
3040  PRINT "UNCONTROLLED THERMAL RUNAWAY.  HOWEVER,"
3050  PRINT "THE CONTAINMENT BUILDING HAS NOT YET"
3060  PRINT "RUPTURED.
3070  PRINT
3080  PRINT "INITIATE YOUR EVACUATION PLAN."
3090  GOTO 5000
3100  PRINT "THE REACTOR CORE HAS MELTED DOWN AND"
3110  PRINT "PRODUCED A STEAM EXPLOSION.  THE"
3120  PRINT "CONTAINMENT BUILDING HAS RUPTURED."
3130  PRINT "LETHAL RADIOACTIVE GASES AND DEBRIS"
3140  PRINT "HAVE ESCAPED."
3150  PRINT
3160  PRINT "INITIATE YOUR EVACUATION AND RADIATION"
3170  PRINT "CLEANUP PLANS AND GET MEDICAL"
3180  PRINT "ASSISTANCE."
3190  GOTO 5000
4000  REM  EVALUATION OF GAME RESULTS
4010  PRINT
4020  PRINT "OVER A PERIOD OF ";DAY%;" DAYS, YOU HAVE"
4030  PRINT "PRODUCED AN AVERAGE POWER OUTPUT OF"
4040  PRINT KW%;" KILOWATTS PER DAY."
4050 AKW% = 1 + (KW% > 1000) + (KW% > 1200) + (KW% > 1500) + (KW% > 1800)
4060  PRINT
4070  PRINT "YOUR AVERAGE POWER PRODUCTION RATE IS"
4080  ON AKW% GOTO 4090,4100,4110,4120,4140
4090  PRINT "HORRIBLE! FIND A LESS DEMANDING JOB.": GOTO 4200
4100  PRINT "WAY BELOW YOUR AREA'S POWER NEEDS.": GOTO 4200
4110  PRINT "ADEQUATE. YOU COULD DO BETTER.": GOTO 4200
4120  PRINT "EXCELLENT! POWER COSTS IN YOUR AREA"
4130  PRINT "WILL NOT BE INCREASED.": GOTO 4200
4140  PRINT "NEAR THE MAXIMUM!  POWER COSTS IN YOUR"
4150  PRINT "AREA WILL DROP SIGNIFICANTLY."
4200  REM DAMAGE EVALUATION
4210  PRINT
4215  GOSUB 2000
4220 D% = 1 + (DMGE% > 10) + (DMGE% > 20) + (DMGE% > 30)
4230  PRINT "THE EQUIPMENT DAMAGE SUSTAINED DURING"
4240  PRINT "THIS PERIOD WAS ";
4250  ON D% GOTO 4260,4270,4280,4290
4260  PRINT "VERY LIGHT.": GOTO 5000
4270  PRINT "MODERATE.": GOTO 5000
4280  PRINT "HEAVY.": GOTO 5000
4290  PRINT "SEVERE."
5000  REM END
5010  PRINT
5020  PRINT "WOULD YOU LIKE TO TRY AGAIN? (Y OR N)";
5030  INPUT A$
5040  IF A$ = "" THEN 5030
5050  IF A$ = "Y" THEN  GOSUB 2000: GOTO 390
5060  HOME
5070  END
5100 B$ = ""
```

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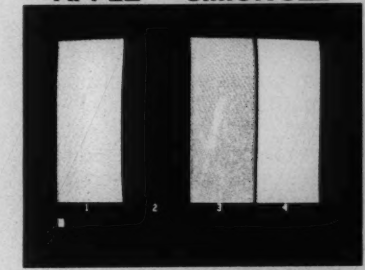

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Power Plant cont'd...

```
5105  FOR I = 1 TO 4
5110  GET A$
5130  IF  ASC (A$) <  > 32 THEN 5140
5134  IF B$ = "" THEN  RETURN
5136 OUT% =  VAL (B$)
5138  RETURN
5140  IF  ASC (A$) = 13 THEN  POP : GOTO 1170
5150 B$ = B$ + A$
5160  PRINT A$;
5170  NEXT I
5180  RETURN
6000  GR : COLOR= 15: FOR I = 0 TO 39: HLIN 0,39 AT I: NEXT I
6005 DE = 6000
6010  HOME : VTAB 23
6020  PRINT "  THIS IS THE REACTOR VESSEL"
6030  RESTORE
6035  COLOR= 1
6040  FOR I = 1 TO 29
6050  READ X1,X2,Y
6060  HLIN X1,X2 AT Y
6070  NEXT I
6080  DATA 7,9,6,15,17,6,6,18,7,5,19,8,5,7,9,17,19,9,5,6,10,18,19,10,5,6,
      11,18,19,11,5,6,12,18,19,12,5,6,13,18,19,13,5,6,14
6090  DATA 18,19,14,5,6,15,18,19,15,5,6,16,18,19,16,5,6,17,18,19,17,5,6,
      18,18,19 ,18,5,7,19,17,19,19,6,18,20,7,17,21,8,16,22
6100  COLOR= 0
6110  HLIN 13,14 AT 6
6120  COLOR= 12
6130  HLIN 14,15 AT 5
6140  HLIN 14,16 AT 4
6150  HLIN 15,16 AT 3
6160  FOR I = 1 TO DE: NEXT I
6170  VTAB 23
6180  PRINT "  THIS IS THE REACTOR CORE      "
6190  COLOR= 8
6200  FOR I = 9 TO 15
6210  VLIN 11,17 AT I
6220  NEXT I
6230  FOR I = 1 TO DE: NEXT I
6240  VTAB 23
6250  PRINT "  THESE ARE THE CONTROL RODS  "
6260  COLOR= 13
6270  VLIN 2,17 AT 11
6280  VLIN 2,17 AT 13
6290  FOR I = 1 TO DE: NEXT I
6300  VTAB 23
6310  PRINT " THE EMERGENCY COOLANT CAN COOL THE"
6320  PRINT " REACTOR IN AN EMERGENCY."
6330  COLOR= 2
6340  FOR I = 1 TO 36
6350  READ Y,X
6360  PLOT X,Y
6370  FOR J = 1 TO 200: NEXT J
6380  NEXT I
6390  DATA 4,2,4,4,5,2,5,3,5,4,6,2,6,3,6,4,7,3,8,3,9,3,10,3,11,3,12,3,
      12,4,12,5, ~~12,6,12,7,12,8,12,9~~
6400  DATA 13,9,14,9,15,9,16,9,16,8,16,7,16,6,16,5,16,4,16,3,17,3,18,3,
      19,3,20,3 ,22,3,24,3
6410  FOR I = 1 TO DE: NEXT I
6420  HOME : VTAB 23
6430  PRINT " THE PRIMARY COOLANT CARRIES HEAT FROM"
6440  PRINT " THE REACTOR CORE TO THE HEAT EXCHANGER"
6450  FOR I = 1 TO 52
6460  READ Y,X
6470  PLOT X,Y
6480  FOR J = 1 TO 200: NEXT J
6490  NEXT I
6500  FOR I = 1 TO DE: NEXT I
6510  DATA 4,25,4,27,5,25,5,26,5,27,6,25,6,26,6,27,7,26,8,26,9,26,10,26,
      11,26,12 ,26,12,25,12,24,12,23,12,22,12,21,12,20,12,19
6515  DATA 12,18,12,17,12,16,12,15,13,15,14,15,15,15,16,15,16,16,16,
      17,16,18
6520  DATA  16,19,16,20,16,21,16,22,16,23,16,24,16,25,16,26,16,27,16,28,
      16,29,16 ,30,15,30,14,30,13,30,13;30,12,30,12,29,12,28,12,27
6540  HOME : VTAB 23
6550  PRINT " THIS IS THE HEAT EXCHANGER"
6560  COLOR= 5
6570  HLIN 28,34 AT 10
6580  VLIN 10,18 AT 34
6590  HLIN 28,34 AT 18
6600  VLIN 10,18 AT 28
6605  COLOR= 2: PLOT 28,12: PLOT 28,16: COLOR= 5
6610  FOR I = 1 TO DE: NEXT I
6620  VTAB 23
6630  PRINT " THIS IS THE GENERATOR TURBINE"
6640  HLIN 5,18 AT 30
6650  VLIN 30,36 AT 18
6660  HLIN 5,18 AT 36
6670  VLIN 30,36 AT 5
```

```
6680  COLOR= 0
6690  HLIN 2,17 AT 33
6700  FOR I = 7 TO 15 STEP 2
6710  PLOT I,34: PLOT I + 1,32
6720  NEXT I
6730  FOR I = 1 TO DE: NEXT I
6740  VTAB 23
6750  PRINT " THIS IS THE COOLING TOWER          "
6760  COLOR= 5
6770  VLIN 23,25 AT 24
6780  VLIN 23,25 AT 36
6790  VLIN 25,26 AT 25
6800  VLIN 25,26 AT 35
6810  VLIN 26,28 AT 26
6820  VLIN 26,28 AT 34
6830  VLIN 28,36 AT 27
6840  VLIN 28,36 AT 33
6850  PLOT 34,36
6860  PLOT 26,36
6870  HLIN 25,35 AT 38
6880  FOR I = 1 TO DE: NEXT I
6890  VTAB 23
6900  PRINT " THE SECONDARY COOLANT CARRIES HEAT"
6910  PRINT " FROM THE HEAT EXCHANGER TO THE "
6920  PRINT " TURBINE AND THEN TO THE COOLING TOWER"
6925  COLOR= 2
6930  FOR I = 1 TO 123
6940  READ Y,X
6950  PLOT X,Y
6960  FOR J = 1 TO 200: NEXT J
6970  NEXT I
6980  DATA 4,35,4,37,5,35,5,36,5,37,6,35,6,36,6,37,7,36,8,36,9,36,10,36,
      11,36,12 ,36,12,35,12,34,12,33,12,32,13,32,14,32,15,32,16,32
6990  DATA 16,33,16,34,16,35,16,36,17,36,18,36,19,36,20,36,20,35,20,34,
      20,33,20, 32,20,31,20,30,20,29,20,28,20,27,20,26,20,25,20,24,20,23,
      20,22,20,21
7000  DATA 21,21,22,21,23,21,24,21,25,21,26,21,27,21,27,20,27,19,27,18,
      27,17,27, 16,27,15,27,14,27,13,27,12,27,11,27,10,27,9,27,8,27,7
7010  DATA 28,7,29,7,30,7,31,7,32,7,34,10,32,13,34,16,35,16,35,17,35,18,
      35,19,35 ,20,35,21,35,22,35,23,35,24,35,25,35,26,35,27,35,28
7020  DATA 34,28,34,29,34,30,35,30,35,31,35,32,34,32,34,33,34,34,34,35,
      34,36,34, 37,34,38,33,38,32,38,31,38,30,38,29,38,28,38,27,38,26,38,
      25,38,24,38,23,38
7030  DATA 22,38,21,38,20,38,19,38,18,38,17,38,16,38,15,38,14,38,13,38,
      12,38,12, 37
7040  HOME : VTAB 23
7060  RETURN
9000  REM VARIABLE PREFIXES
9010  REM A-CONTROL RODS, C-COOLING TOWER, E-EMERGENCY COOLANT,
      G-TURBINE, P-PRIMARY COOLANT, R-REACTOR, S-SECONDARY COOLANT,
      X-HEAT EXCHANGER
9020  REM VARIABLE SUFFIXES
9030  REM B-BROKEN, D-DAMAGE, F-FLOW RATE, H-HEAT FLOW, L-LIFE, O-OUTPUT,
      T-TEMPERATURE, V-VOLUME
9040  REM OTHER VARIABLES TOT-TOTAL POWER OUTPUT, KW-AVERAGE POWER
      OUTPUT, DAY-DAY OF OPERATION, DMGE-TOTAL EQUIPMENT DAMAGE
9050  REM PROGRAM DISCRIPTION BY LINE NUMBER
9060  REM 10-220 INTRODUCTION
9070  REM 225-380 INSTRUCTIONS
9080  REM 390-455 VARIABLE INITIATION
9090  REM  460-850 WRITE REPORT AND ASSESS DAMAGE
9100  REM  900-1165 INPUT NEW CONTROL VARIABLES
9110  REM 1170 MAINTENANCE SHUTDOWN EVALUATION
9120  REM 1200-1260 PUMP FAILURE ASSESSMENT
9130  REM 1270-1430 PLANT OPERATING ALGORITHMS
9140  REM 2000-2200 MAINTENANCE SHUTDOWN SUBROUTINE
9150  REM 3000-3190 MELTDOWN ENDING
9160  REM 4000-4290 EVALUATION OF GAME RESULTS
9170  REM 5000-5070 END
9180  REM 6000-7060 PLANT DIAGRAM SUBROUTINE
9190  REM 9000-9190 REMARKS
9200  REM  APPLE NUCLEAR POWER PLANT
9210  REM  BY STEPHEN R BERGGREN
```

```
RUN
       APPLE NUCLEAR POWER PLANT
        BY STEPHEN R. BERGGREN

THIS PROGRAM SIMULATES THE OPERATION OF
A NUCLEAR POWER REACTOR.  THE OBJECT
IS TO OPERATE THE PLANT AT A MAXIMUM
AVERAGE POWER OUTPUT WITHOUT CAUSING
A REACTOR MELTDOWN.

THE CONTROL RODS ADJUST THE AMOUNT OF
HEAT PRODUCED BY THE REACTOR.  PRIMARY
COOLANT TRANSFERS THIS HEAT TO THE HEAT
EXCHANGER.  SECONDARY COOLANT TRANSFERS
HEAT FROM THE HEAT EXCHANGER TO THE
TURBINE, WHERE POWER IS PRODUCED, AND
FINALLY TO THE COOLING TOWER.
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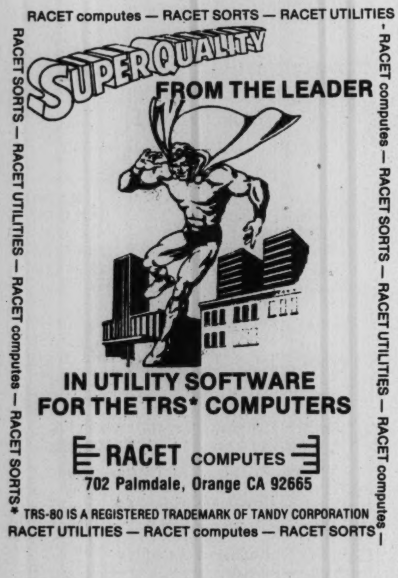

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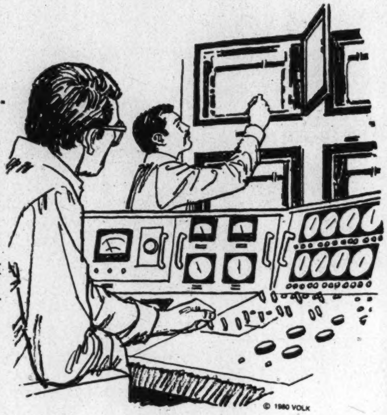
CIRCLE 244 ON READER SERVICE CARD

Power Plant cont'd...



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```
THE EMERGENCY COOLANT IS USED TO HELP SHUT
DOWN THE REACTOR WHEN OTHER SYSTEMS
FAIL.  UNLIKE THE OTHER COOLANTS,
EMERGENCY COOLANT IS NOT RECYCLED.

ENTER 'D' TO SEE REACTOR DIAGRAM      ENTER 'I' FOR WORKING INSTRUCTIONS
ENTER 'S' TO START OPERATION
THE CONTROLS ARE OPERATED BY TYPING IN
THE DESIRED CONTROL ROD SETTING AND
FLOW RATES.(USE VALUES FROM 0 TO 100)
IF NO ENTRY IS MADE, THE VALUES WILL
NOT CHANGE.  USE THE SPACE BAR TO STEP
TO THE DIFFERENT FUNCTIONS.  WHEN THE
DESIRED ENTRIES HAVE BEEN MADE, USE THE
'RETURN' KEY TO ADVANCE TO THE NEXT DAY.
THE REACTOR CAN BE OPERATED UNTIL A
MELTDOWN OCCURS OR THE REACTOR FUEL IS
EXHAUSTED.  THE FUEL WILL LAST FOR
ABOUT 100 TO 150 DAYS.  WHEN THE FUEL
IS EXHAUSTED, YOUR PERFORMANCE WILL BE
EVALUATED.

    (PRESS RETURN TO CONTINUE)

IF YOU WANT TO REPAIR DAMAGE OR REPLACE
COOLANT, BRING THE REACTOR TEMPERATURE
DOWN BELOW 100 AND SHUT OFF THE COOLANT
FLOWS.  THIS WILL CAUSE AN AUTOMATIC
MAINTENANCE SHUTDOWN AND ALL COOLANT
WILL BE REPLENISHED AND REPAIRS MADE.
THE GREATER THE DAMAGE, THE LONGER THE
REPAIRS WILL TAKE.

     WARNING: THIS POWER PLANT HAS
     NO AUTOMATIC SAFETY DEVICES!!


ENTER 'D' TO SEE REACTOR DIAGRAM   ENTER 'I' FOR WORKING INSTRUCTIONS
ENTER 'S' TO START OPERATION          S
      APPLE NUCLEAR POWER PLANT
        STATUS REPORT - DAY 1

WARNINGS:
 POWER OUTPUT LOW

DAMAGE:

INDICATORS:
 REACTOR TEMP. (MAX 800) 25
 HEAT EXCHANGER TEMP. (MAX 500) 25
 COOLING TOWER TEMP. (MAX 300) 25
 POWER OUTPUT (MAX 2000KW) 0KW
 AVERAGE POWER OUTPUT  0KW/DAY
 CONTROL RODS- 0
 COOLANTS
  EMERGENCY  LEVEL- 300  FLOW- 0
  PRIMARY    LEVEL- 120  FLOW- 0
  SECONDARY  LEVEL- 120  FLOW- 01
        STATUS REPORT - DAY 2

WARNINGS:
 POWER OUTPUT LOW

DAMAGE:

INDICATORS:
 REACTOR TEMP. (MAX 800) 26
 HEAT EXCHANGER TEMP. (MAX 500) 25
 COOLING TOWER TEMP. (MAX 300) 25
 POWER OUTPUT (MAX 2000KW) 0KW
 AVERAGE POWER OUTPUT  0KW/DAY
 CONTROL RODS- 1
 COOLANTS
  EMERGENCY  LEVEL- 300  FLOW- 0
  PRIMARY    LEVEL- 120  FLOW- 0
  SECONDARY  LEVEL- 120  FLOW- 0100

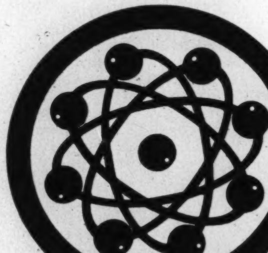


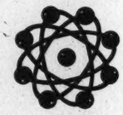
       APPLE NUCLEAR POWER PLANT
        STATUS REPORT - DAY 19

WARNINGS:

DAMAGE:
 SECONDARY COOLANT LEAK - 5/DAY

INDICATORS:
 REACTOR TEMP. (MAX 800) 778
 HEAT EXCHANGER TEMP. (MAX 500) 465
```





```
COOLING TOWER TEMP. (MAX 300) 254
POWER OUTPUT (MAX 2000KW) 1858KW
AVERAGE POWER OUTPUT  1478KW/DAY
CONTROL RODS- 9
COOLANTS
 EMERGENCY  LEVEL- 300  FLOW- 0
 PRIMARY    LEVEL- 120  FLOW- 70
 SECONDARY  LEVEL- 105  FLOW- 100
       STATUS REPORT - DAY 20


       APPLE NUCLEAR POWER PLANT
        STATUS REPORT - DAY 23

WARNINGS:
 HEAT EXCHANGER OVERHEATED
 COOLING TOWER OVERHEATED
 POWER OUTPUT LOW
 SECONDARY COOLANT LOW

DAMAGE:
 SECONDARY COOLANT LEAK - 11/DAY
 SECONDARY COOLANT PUMP FAILURE - 100%

INDICATORS:
 REACTOR TEMP. (MAX 800) 783
 HEAT EXCHANGER TEMP. (MAX 500) 667
 COOLING TOWER TEMP. (MAX 300) 327
 POWER OUTPUT (MAX 2000KW) 790KW
 AVERAGE POWER OUTPUT  1487KW/DAY
 CONTROL RODS- 9
 COOLANTS
  EMERGENCY  LEVEL- 300  FLOW- 0
  PRIMARY    LEVEL- 120  FLOW- 70
  SECONDARY  LEVEL- 76  FLOW- 20

       APPLE NUCLEAR POWER PLANT
        STATUS REPORT - DAY 30

WARNINGS:
 POWER OUTPUT LOW
 EMERGENCY COOLANT LOW
 PRIMARY COOLANT LOW
 SECONDARY COOLANT LOW
```

```
DAMAGE:
 PRIMARY COOLANT LEAK - 7/DAY
 SECONDARY COOLANT LEAK - 19/DAY
 PRIMARY COOLANT PUMP FAILURE - 70%
 SECONDARY COOLANT PUMP FAILURE - 100%
 HEAT EXCHANGER FAILURE

INDICATORS:
 REACTOR TEMP. (MAX 800) 96
 HEAT EXCHANGER TEMP. (MAX 500) 81
 COOLING TOWER TEMP. (MAX 300) 25
 POWER OUTPUT (MAX 2000KW) 0KW
 AVERAGE POWER OUTPUT  1140KW/DAY
 CONTROL RODS- 0
 COOLANTS
  EMERGENCY  LEVEL- 0  FLOW- 0
  PRIMARY    LEVEL- 82  FLOW- 0
  SECONDARY  LEVEL- 0  FLOW- 0
       MAINTENANCE SHUTDOWN - 32 DAYS
       APPLE NUCLEAR POWER PLANT
        STATUS REPORT - DAY 63

       APPLE NUCLEAR POWER PLANT
        STATUS REPORT - DAY 69

WARNINGS:
 REACTOR OVERHEATED
 TURBINE OVERLOADED

DAMAGE:
 REACTOR CORE DAMAGED
 EMERGENCY COOLANT LEAK - 10/DAY

      MELTDOWN!  MELTDOWN!  MELTDOWN!

THE REACTOR CORE HAS MELTED DOWN AND
PRODUCED A STEAM EXPLOSION.  THE
CONTAINMENT BUILDING HAS RUPTURED.
LETHAL RADIOACTIVE GASES AND DEBRIS
HAVE ESCAPED.

INITIATE YOUR EVACUATION AND RADIATION
CLEANUP PLANS AND GET MEDICAL
ASSISTANCE.

WOULD YOU LIKE TO TRY AGAIN? (Y OR N)?N
```

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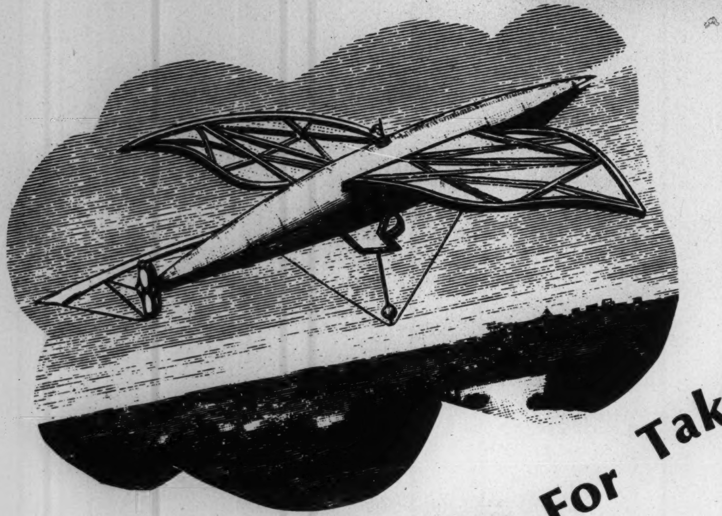
CIRCLE 187 ON READER SERVICE CARD

Balancing Your Light Plane by Computer



Weighting For Take off

David L. Phillips

Please note that this program has not been certified by the FAA and is published as a novelty only representing the opinions of the author.

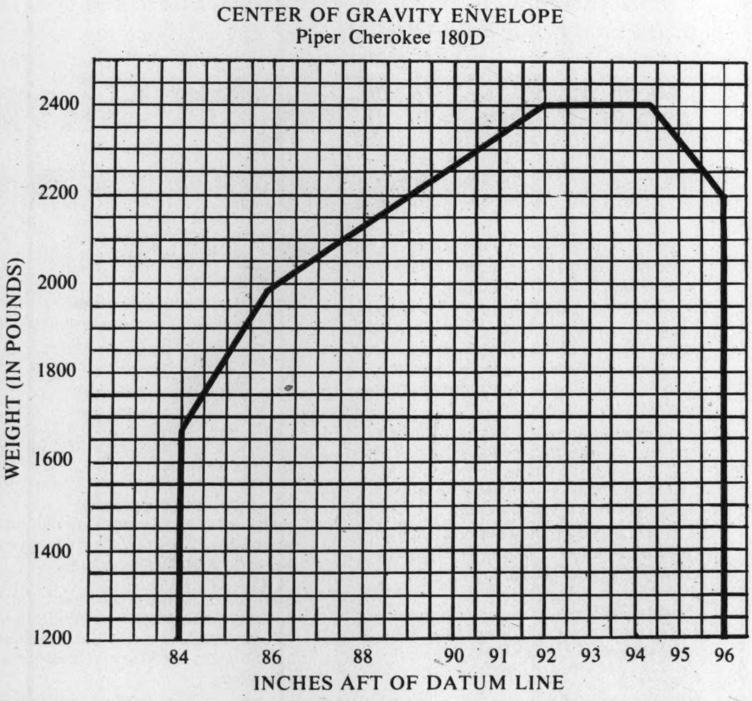
When you fly small aircraft, you learn quickly that you have to pay attention to the weight and distribution of the payload you plan to carry. There are several reasons, all related to the limited carrying capacity of light aircraft.

If the load is too heavy, the plane won't take off, or it won't climb very well if you do manage to horse it off the ground. Or the load might be concentrated toward the rear of the plane, in which case the nose will come up, but uncontrollably, so the plane will climb too steeply and stall out, falling to the ground (a definite no-no!). That gives you the idea.

A pilot also learns that computing weight and balance is a complicated, time-consuming chore, and that tends to make one try to rationalize it away as not being necessary in "obvious" cases. The complications are that one must determine actual weight of various elements: oil, fuel, front passengers, rear passengers and baggage, as well, of course, as the empty weight of the aircraft.

These elements each have a discrete "arm aft datum" depending on their distance from a reference point — the datum line (in the case of my Cherokee

David L. Phillips, 471 Park Lane, State College, PA 16801.



CENTER OF GRAVITY ENVELOPE
Piper Cherokee 180D

Figure 1

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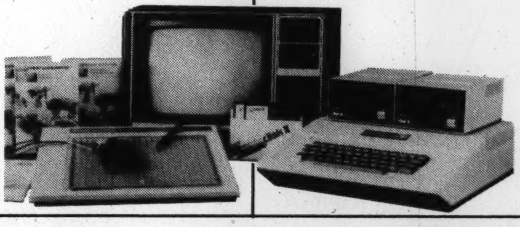

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CIRCLE 133 ON READER SERVICE CARD

Plane, cont'd...

180, roughly the front of the engine compartment). The propellor, for example, is a small negative number; pilot and front passenger are at 85.5 inches. Weight multipled by the arm aft datum for each element provides the "moment of force" in inch-pounds. Total moment for all elements divided by the total weight gives an overall arm aft datum for the loaded plane, or its "center of gravity."

If the total weight is less than allowable gross weight (2400 pounds in this case), and if the baggage weight is less than 200 pounds (maximum allowed for the Cherokee 180), you still have to determine whether the load is too far forward or rearward — is it within the center of gravity "envelope" specified by the manufacturer (see Figure 1)? For each weight, the chart shows the envelope parameters. At 2400 pounds, for example, the forward limit is 92.1 and the rearward limit is 94.5; at 1650 pounds, these are 84.0 and 95.9.

In the days before pocket calculators, this was a laborious task indeed. You end up adding five- and six-digit numbers and dividing the result by a four-digit number — not a happy task for people who want to be flying airplanes and not being accountants. Even today, doing this job manually takes some thinking and doing (see Figure 2).

On the other hand, the home computer can accomplish the total computation in less than 15 seconds, including the input of four pieces of data (assuming normal typing competence). It will not only tell you the total weight of the loaded plane and whether it is in the CG envelope but also the maximum amount of baggage you can carry to stay within allowable limits. Or you can input the amount of baggage you want to carry and the program will tell you whether it's allowable. (By the way, 50 and 36 gallons are specified because those are convenient in filling the Cherokee's tanks; any number will be calculated.)

Inputs are at lines 110, 120, 140 and 235. Note that the program does not ask for baggage until it calculates whether there is room for any, based on the passenger and fuel inputs. It is possible for it to kick out at line 234 with the warning that "Weight is (XX) pounds over gross without baggage!" A second "over-gross" flag is contained in line 500.

Lines 610 to 830 compare the overall arm aft datum with the allowable limits for the total weight as calculated.

With this program, I find that I actually enjoy working out various permutations of where to place passengers, how much fuel to carry versus payload, etc. That can only enhance the safety factor of weight and balance in small aircraft. It sure makes me feel more comfortable when I load up and take off! □

SAMPLE LOADING PROBLEM
Piper Cherokee 180D

	Weight (lbs)	Arm Aft Datum (inches)	Moment (inch-pounds)
Licensed Empty Weight	1402.0	86.2	120852
Oil (6 quarts)	11.0	32.5	357.5
Pilot and Front Passenger	340.0	85.5	29070
Rear Passengers	340.0	118.1	40154
Fuel (36 gals. — 50 max.)	216.0	95.0	20520
Baggage (200 lbs. max.)	91.0	142.8	12994.8
TOTAL, LOADED AIRCRAFT	2400.0	93.3 (calc.)	223948.3

Figure 2

```
10 REM ** WEIGHT & BALANCE COMPUTATION **
20 REM ** CHEROKEE 180D **
30 REM ** BY DAVID L. PHILLIPS **
40 REM ** VARIABLES DEFINED **
50 REM ** ARM AFT DATUM (IN INCHES): EMPTY WT = EA ** OIL =OA **
 PILOT & FRONT PASSENGER = FA ** REAR PASSENGERS = RA ** BAGGAGE
 = BA ***
55 REM *** MOMENT (INCH/POUNDS): EM=EMPTY WT ** GW=GROSS WT ** O
M=OIL ** FM=FRONT PASSENGERS ** RM=REAR PASSENGERS ** FW=FUEL **
*
60 REM *** PW=TOTAL WT W/OUT BAGGAGE ** OG=WT OVER ALLOWABLE GRO
SS W/OUT BAGGAGE ***
65 REM *** TW=TOTAL WT ** TM=TOTAL MOMENT ***
70 REM *** FW=FUEL WT ** FI=FUEL MOMENT ***
100 EW = 1402
105 CLS:PRINT:PRINT
110 INPUT "WHAT IS COMBINED WEIGHT OF FRONT PASSENGERS";FP
120 INPUT "WHAT IS COMBINED WEIGHT OF REAR PASSENGERS";RP
130 OIL = 11
140 INPUT "HOW MUCH FUEL (50 OR 36 GALLONS)";FU
150 EA = 86.2
160 OA = 32.5
170 FA = 85.5
180 RA = 118.1
190 BA= 142.8
200 EM = EW*EA
205 GW=2400
210 OM = OI*OA
220 FM = FP*FA
230 RM = RP*RA
231 FW = FU * 6
232 PW=EW+FP+RP+FW+OI
233 OG=PW-GW
234 IF PW>2400 PRINT"WEIGHT IS";OG;"POUNDS OVER GROSS WITHOUT BA
GGAGE!":END
235 INPUT "DO YOU HAVE BAGGAGE WEIGHT TO CALCULATE";BC$
236 IF BC$ = "NO" THEN BG=GW-PW:GOTO 240
237 INPUT "WHAT IS THE WEIGHT";BG
240 IF BG>200 THEN BG=200
245 BM=BA*BG
250 GW = 2400
256 FI=FW*95
280 TW = EW + FP + RP + FW + OI + BG
282 IF TW>2400 GOTO 500
285 PRINT:PRINT "MAXIMUM BAGGAGE ALLOWANCE IS";BG;"POUNDS."
286 TM = EM+OM+FM+RM+FI+BM
287 FL=TM/TW
300 IF TW <= 2400 AND TW>2200 GOTO 600
310 IF TW <=2200 AND TW>1975 GOTO 700
320 IF TW <=1975 AND TW>1650 GOTO 800
500 TD = TW-GW:PRINT "TOTAL WEIGHT IS OVER GROSS BY";TD;"POUNDS"
:END
600 PRINT "TOTAL WEIGHT IS";TW "POUNDS."
610 IF FL<89.2 PRINT "CG IS BEYOND FORWARD LIMIT!":END
620 IF FL>95.9 PRINT "CG IS BEYOND REARWARD LIMIT!":END
630 IF FL=>89.2 AND FL<=95.9 PRINT "CG IS IN ENVELOPE.":END
700 PRINT "TOTAL WEIGHT IS";TW;"POUNDS."
710 IF FL<89.2 PRINT "CG IS BEYOND FORWARD LIMIT!":END
720 IF FL>95.9 PRINT "CG IS BEYOND REARWARD LIMIT!":END
730 IF FL=>85.9 AND FL<=95.9 PRINT "CG IS IN ENVELOPE.":END
800 PRINT "TOTAL WEIGHT IS";TW;" POUNDS."
810 IF FL<84 PRINT "CG IS BEYOND FORWARD LIMIT!":END
820 IF FL>95.9 PRINT "CG IS BEYOND REARWARD LIMIT:END
830 IF FL=>84.0 AND FL<=95.9 PRINT "CG IS IN ENVELOPE.":END
999 END
```

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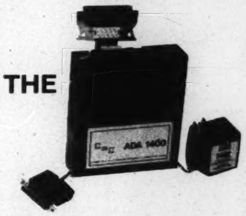

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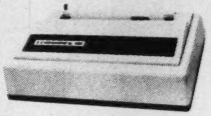

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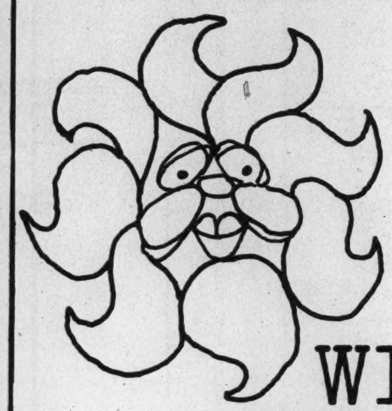


WEATHER STATION

Paul Raymer

The most pressing problem the average computer owner faces is the weather. Some folks may feel that developing new algorithms, testing out logic problems, running simulation and adventure games or performing complex mathematical tasks have a greater priority, but when I asked the two people I know who have computers, they agreed with me, it *was* weather.

The following "Weather Station" program will bring your computer in touch with the real world, without expensive electronic coupling devices or complex meteorological equipment. No hardware modifications to your computer will be required.

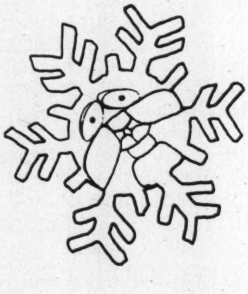
You will need only a plain white piece of paper, approximately 8½" x 11" (21.59 x 27.94 cm) and a pencil and a pad for writing down certain scientific data. No prior knowledge of weather forecasting is required, but such knowledge may prove to be helpful.

Although this program is written for the Apple II in Applesoft Basic, it can easily be translated to any Microsoft Basic dialect with a few dozen simple, but tedious, changes.

The program and listing is restricted to personal use only and may not be used by local radio and/or television stations for forecasting the weather, without permission. □

Paul Raymer, P.O. Box 42831, Las Vegas, NV 89104.

```
]PR#0
]PRINT""
]LIST
100  REM
110  REM  ********************
120  REM  *                  *
130  REM  * WEATHER  STATION *
140  REM  *                  *
150  REM  *   PAUL RAYMER    *
160  REM  *    POB 42831     *
170  REM  * LAS VEGAS NEVADA *
180  REM  *      89104       *
190  REM  *                  *
200  REM  ********************
210  REM
220  REM  I/XXIX/MCMLXXX
230  REM
240  REM  THIS PRINTS THE TITLE NEATLY
250  REM
260  TEXT : HOME : CLEAR
270  VTAB 10: HTAB 12: PRINT "WEATHER STATION"
280  FOR M = 1 TO 2000: NEXT M
290  CALL  - 936
300  REM
310  REM  INSTRUCTIONS FOR USE
320  REM
330  PRINT "YOU NOW HAVE THE ABILITY TO INTERFACE"
340  PRINT "YOUR COMPUTER WITH THE OUTSIDE WORLD.": PRINT
350  PRINT "TAKE AN ORDINARY SHEET OF PAPER ABOUT"
```



```
360  PRINT "8-1/2 X 11 (ORDINARY TYPING PAPER WILL"
370  PRINT "DO) AND PLACE IT OUTDOORS FOR FIVE"
380  PRINT "MINUTES.": PRINT
390  PRINT "THE COMPUTER WILL NOW GO INTO A HOLDING"
400  PRINT "PATTERN FOR ABOUT FIVE MINUTES OR SO..."
410  FOR X = 1 TO 10000: NEXT X
420  CALL  - 936: FOR X = 1 TO 5: PRINT  CHR$ (7): NEXT X
430  PRINT "WHEN READY PRESS SPACE BAR TO GET THE "
440  PRINT "WEATHER REPORT ";: GET A$
450  CALL  - 936: FOR X = 1 TO 1000: NEXT X
460  REM
470  REM  HUMAN INTERACTION WITH REFERENCE MATERIAL
480  REM
490  PRINT "PLEASE ANSWER THE FOLLOWING QUESTIONS"
500  REM
510  REM  DELAY LOOPS GIVING TIME FOR HUMANS TO THINK
520  REM
530  GOSUB 1170
540  PRINT "WITH EXTREME ACCURACY TO INSURE MOST"
550  GOSUB 1170
560  PRINT "SCIENTIFIC RESULTS.": PRINT
570  GOSUB 1170
580  GOSUB 1210
590  INPUT "WAS THE PAPER STILL OUTSIDE? ";S$
600  GOSUB 1170
610  GOSUB 1210
620  INPUT "WAS THE PAPER WET?";R$
630  GOSUB 1170
640  GOSUB 1210
650  INPUT "DID THE PAPER MOVE?";W$
660  GOSUB 1170
670  GOSUB 1210
680  REM
690  REM  NOTE CLEVER USE OF 'IF' STATEMENT
700  REM
710  IF  LEFT$ (W$,1) = "Y" THEN  PRINT "IN WHICH DIRECTION? ";: INPUT D$
720  GOSUB 1170
730  GOSUB 1210
740  IF  LEN (D$) > 0 THEN  PRINT "HOW FAR? ";: INPUT F$
750  GOSUB 1170
760  GOSUB 1210: GOSUB 1210: CALL  - 936
770  REM
780  REM  USE OF FOLLOWING SLOW PRINTOUT OPTIONAL WITH SKILL IN UNDERSTAND
     ING METEOROLOGICAL INFORMATION
790  REM
800  SPEED= 100
810  PRINT "HERE IS TODAY'S WEATHER REPORT BASED ON"
820  PRINT "SCIENTIFIC DATA YOU HAVE ENTERED INTO"
830  PRINT "THE COMPUTER...": PRINT
840  REM
850  REM  DOING METEORLOGICAL STUDY OF DATA AND OTHER STUFF FED INTO COMPU
     TER
860  REM
870  REM
880  REM  EXTREME HIGH WIND INDICATOR
890  REM
900  IF  LEFT$ (S$,1) = "N" THEN  PRINT "TORNADO APPROACHING!"
910  REM
920  REM  MOISTURE FACTOR ANALYZER
930  REM
940  IF  LEFT$ (R$,1) = "Y" THEN  PRINT "RAIN PROBABILITY 90% -- SHOWERS L
     IKELY  TOMORROW"
950  REM
960  REM  WIND VELOCITY SCALE
970  REM
980  IF  VAL (F$) > 0 THEN X1$ = " MILD"
990  IF  VAL (F$) = 3 THEN X1$ = " MODERATE"
1000  IF  VAL (F$) > 3 THEN X1$ = " STRONG"
1010  REM
1020  REM  ELECTRONIC WIND SOCK
1030  REM
1040  IF  LEFT$ (W$,1) = "Y" THEN X2$ = " WIND"
1050  IF  LEFT$ (D$,1) = "E" THEN X3$ = " WEST"
1060  IF  LEFT$ (D$,1) = "W" THEN X3$ = " EAST"
1070  IF  LEFT$ (D$,1) = "N" THEN X3$ = " SOUTH"
1080  IF  LEFT$ (D$,1) = "S" THEN X3$ = " NORTH"
1090  IF  LEFT$ (W$,1) = "Y" THEN  PRINT "A";X1$;X2$;" IS BLOWING FROM THE
     ";X3$
1100  REM
1110  REM  NICE WEATHER DATA BANK
1120  REM
1130  IF  LEFT$ (R$,1) = "N" THEN  PRINT "WEATHER CLEAR AND DRY"
1140  IF  LEFT$ (W$,1) = "N" THEN  PRINT "AIR IS CALM AT PRESENT"
1150  SPEED= 255
1160  END
1170  FOR M = 1 TO 100: NEXT M: RETURN
1180  REM
1190  REM  CHEAP WAY TO MAKE TALKIES OUT OF YOUR SILENT WEATHER REPORTS
1200  REM
1210  FOR X = 1 TO 3: PRINT  CHR$ (7): NEXT X: RETURN
```

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☐In addition to the above commands, Model I ENHBAS contains *vector graphics* and drawing commands. Model II ENHBAS has many functions suited to business programming—ISAM file handling commands, RS-232 access, and many more; along with several Model I BASIC commands left out of Model II (PEEK, POKE, OUT, etc.).

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CIRCLE 162 ON READER SERVICE CARD

IT'S A BLURB—

IT'S A GAME—

IT'S SUPERMAN

Bill Dyck

The setting of "Superman" is in the fine city of Metropolis, U.S.A. You, as Superman, must rid the city of the ten super criminals hiding in 18 different areas. If you can't achieve this within the 80 hours given to you, or if one of the criminals destroys you, it gives the rest the chance to get to their hide-away and push the button that finishes their plan to take over the world. In other words, if one of these things happens to you, you lose.

To start with, you have a certain amount of energy (between 4000 and 5000 calories) given to you. As you go after each criminal, you lose parts of that energy, but as soon as you have destroyed the criminal, the full amount of energy is restored. The way energy is lost is through the pound of kryptonite that each of the super criminals have in their possession. The closer you get to them, the more energy you lose. If the level of energy ever goes below zero, or if you accidentally move yourself right on top of a super criminal, it gives that criminal a chance to take out his long-held aggressions against you, and you lose the game.

To find and destroy the ten criminals, you have a total of five different abilities. The first and second abilities are used for finding the criminals and the last three for destroying the criminals. Here is a description of all five:

1. Flying: used to move both inside and outside of the areas.

2. X-ray Vision: used to see if there is a criminal in your area, and then to see approximately how far away he is from you.

3. Heat Vision: can only be used within 20 paces of the criminal and has a 30% chance of nailing him.

4. Super Strength: can only be used within 10 paces of the criminal and has a 50% chance of getting him.

5. Super Breath: can only be used within 30 paces of the criminal and has a 20% chance of destroying him.

Once you have scourged Metropolis of the criminals, you have won the game. It is as simple as that, but don't be fooled. It's not as easy as it looks.

The basic strategy that I have used (but with limited success) is to go to one end of the city and work my way down to the other end. That way you don't miss any of the criminals by accidentally skipping over them and then not knowing where they are hiding. The only problem with this is that the game sometimes becomes a little boring due to repetition. You might want to jump around and just go by luck (or if you are blessed with ESP, you can use that).

A Detailed Description

Here is a description of the two different sections of this program (line by line), and also a description of the different variables and what they are used for in the program.

Lines 10-340: Assigns values to the various variables and gives the option of instructions.

Lines 350-430: Command section.

Lines 440-490: X-Ray Vision command.

Lines 500-1000: Flying command.

1. Lines 570-740: move inside of the area.
2. Lines 740-1000: move outside to another area.

Lines 1010-1230: Heat Vision command.

Lines 1240-1410: Super Strength command.

Lines 1420-1590: Super Breath command.

Lines 1600-1860: Program completion statements and replay choice.

Lines 1870-2650: Subroutine for the instructions.

Lines 2660-2770: Subroutine for an unacceptable command number.

Lines 2780-2880: Subroutine to place the criminals in their different areas.

Lines 2890-3140: Subroutine to find out how far you are from the criminal.

Lines 3150-3310: Subroutine for X-Ray Vision.

Lines 3320-3580: Subroutine to see how much energy you have left.

1. Lines 3360-3460: Energy is taken off if the criminal is on the right side of Superman.
2. Lines 3470-3560: Energy is taken off if the criminal is on the left side of Superman.

Lines 3590-3690: Subroutine to see if Superman won and reassign variables.

Lines 3700-4100: Subroutine for the names of the 18 different areas.

Lines 4110-4230: Subroutine to assign the criminal's number to him.

Lines 4240-4450: Subroutine for the names of the ten different criminals.

Lines 4460-4490: Subroutine to assign the beginning amount of energy.

Lines 4500-4530: Subroutine to end the game if time has run out.

Lines 4540-4600: Subroutine to return you to the areas you were last at if you try to visit an area already visited.

Lines 4610-4650: Subroutine to force you to move on after nailing the criminal in that area.

Variables

A — Number of the command wanted.

A(1-10) — Numbers to tell which criminal is in the area you are in (if there is one).

B — Variable that tells which criminal you are working on (10-B tells how many

Bill Dyck, 1119 S. Cryier Ave., Reedley, CA 93654.

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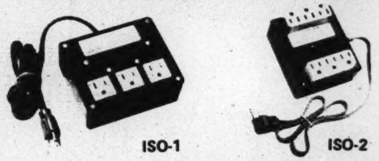

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CIRCLE 142 ON READER SERVICE CARD

The Apple Shoppe

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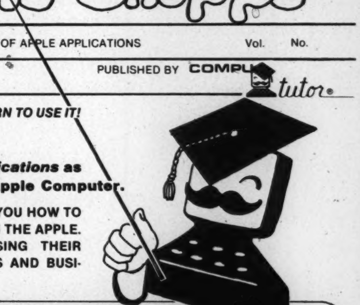

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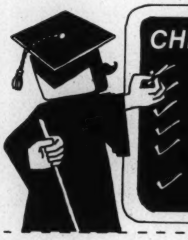

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CIRCLE 149 ON READER SERVICE CARD

Superman cont'd...

criminals there are left to nail).

B7 — Flag to tell the computer if the areas being read are being used for the instructions or for the rest of the program.

C — Position of the criminal in the areas.

C5 — Flag to tell the computer if a criminal is in your area.

C8 — Real distance from the criminal if C is greater than M.

C9 — Approximate distance from the criminal if C is greater than M.

D4 — Flag to tell the computer if Superman has lost all of his energy.

E(1-9) — Check used to see if a criminal is in your area if Q is less than 10.

F(1-9) — Check used to see if a criminal is in your area if Q is more than 9.

G1 — Running amount of energy.

G2 — Amount of energy taken off as you get closer to the criminal.

G7 — Returns the original amount of energy to G1 once you have nailed the criminal in your present area.

H — Hours left before the criminals win.

I — Amount of paces or areas to move over inside or outside of the areas.

K — Flag to tell the computer if Superman has moved after he nailed the criminal in that area.

L(1-18) — Flag to tell the computer whether or not you have already visited the area to which you just moved.

M8 — Real distance from the criminal if M is greater than C.

M9 — Approximate distance from the criminal if M is greater than C.

M — Position of Superman in the areas.

N(1-10) — Number that is compared to either E(1-9) or F(1-9) to see if there is a criminal in your present area.

Q — Number of the area in which you are presently.

R2 — Random number used to determine the chance of Superman nailing the criminal.

T — Area number reserved in case you have to be returned because of trying to visit an area to which you have already been.

T0 — Breaks down your distance from the criminal to determine how much energy to take off.

W — Flag to tell the computer if Superman has won the game.

X7 — Flag to tell the computer if Superman has used his X-Ray Vision in the area where he is currently.

C$ — Area name reserved in case you have to be returned because of trying to visit an area to which you have already been.

H$ — The name of the area in which you are currently.

N$ — The name of the criminal you are currently fighting.

X$ — Direction to move and all other miscellaneous strings.

Modifications

Here are some modifications you can use to make the program a little simpler (and easier, if you find that you are never winning).

1. You can increase the chance of nailing the criminal in lines 1100, 1320, and 1500.
2. You can lessen the amount of energy you lose as you get closer to the criminal you are fighting in lines 3390 and 3500.
3. You can make the amount of energy you start off with larger in lines 4450 and 4460.
4. You can lessen the randomness of the approximation of the distance between you and the criminal.
5. You can raise the time limit in line 60.

Also, if you find this program too easy and you are winning all of the time (which would take a miracle), you could do the exact opposite to the above points (which is obvious, but I thought I would mention it anyway).

Since this program is pretty long, there are also some modifications you can do to the program to make it shorter.

1. You can cut out all of the instructions, or you can make two separate programs — one with the instructions and the other with the rest of the program — and chain the two together.
2. Using data statements, you could assign the names of the areas and criminals to such strings as H$(1) or N$(5). Since the computer I used wouldn't accept such statements, I had to make the program much more bulky by changing H$ every time Superman moved to a different area.

I leave it to you to find out any others, which, if you are clever enough, will surely be there.

The computer system I used for this program has several quirks in its use of Basic. In lines 430, 3710, 3910 and 4230, the statement 'Goto X of linenumber, linenumber' appears. In all Microsoft Basics, it is only accepted as 'On X goto linenumber, linenumber.' In lines 40 and 3660, there are multiple assignment statements. In your computer, you might have to put each of the variables on a different line. In the instructions, several lines are used such as 1980 (which is 'Hit return when ready'). You might have to input something instead of just hitting 'return.' Don't worry about it, because it won't cause the rest of the program any harm.

If your computer system has a bell function, it could be used in lines 1170, 1390, 1570 and 1640 as a signal that you have either nailed a criminal or won the game.

Well, that is the whole program in great detail. I sure hope you have as much fun with it as I have. Oh yeah, before I finish, I want to wish you good luck with the game. You'll need it. □

—Program begins on Page 148—

DYNACOMP

Quality software for:

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GAMES

BRIDGE 2.0 (Available for all computers) **Price: $17.95 Cassette**
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HEARTS 1.5 (Available for all computers) **Price: $14.95 Cassette**
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An exciting and entertaining computer version of this popular card game. Hearts is a trick-oriented game in which the purpose is not to take any hearts or the queen of spades. Play against two computer opponents who are armed with hard-to-beat playing strategies.

CRIBBAGE 2.0 (TRS-80 only) **Price: $14.95 Cassette**
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This is a well-designed and nicely executed two-handed version of the classic card game, cribbage. It is an excellent program for the cribbage player in search of a worthy opponent as well as the beginner wishing to learn the game, in particular the scoring and jargon. The standard cribbage score board is continually shown at the top of the display (utilizing the TRS-80's graphics capabilities), with the cards shown underneath. The computer automatically scores and also announces the points using the traditional phrases.

CHESS MASTER (North Star and TRS-80 only) **Price: $19.95 Cassette**
$23.95 Diskette

This complete and very powerful program provides five levels of play. It includes castling, en passant captures and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the program is written in assembly language (by SOFTWARE SPECIALISTS of California). Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users.

STARTREK 3.2 (Available for all computers) **Price: $ 9.95 Cassette**
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This is the classic Startrek simulation, but with several new features. For example, the Klingons now shoot at the Enterprise without warning while also attacking starbases in other quadrants. The Klingons also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Enterprise is besieged by three heavy cruisers and a starbase S.O.S. is received! The Klingons get even!

SPACE TILT (Apple only) **Price: $10.95 Cassette**
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Use the game paddles to tilt the plane of the TV screen to "roll" a ball into a hole in the screen. Sound simple? Not when the hole gets smaller and smaller! A built-in timer allows you to measure your skill against others in this habit-forming action game.

GAMES PACK I and GAMES PACK II **Price: $ 9.95 each, Cassette**
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STUD POKER (ATARI only) **Price: $11.95 Cassette**
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This is the classic gambler's card game. The computer deals the cards one at a time and you (and the computer) bet on what you see. The computer does not cheat and *usually* bets the odds. However, it sometimes bluffs! Also included is a five card draw poker betting practice program. This package will run on a 16K ATARI.

STATISTICS and ENGINEERING

DATA SMOOTHER (Available for all computers) **Price: $14.95 Cassette**
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This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) **Price: $14.95 Cassette**
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Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

TFA (Transfer Function Analyzer) **Price: $19.95 Cassette**
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This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

FOURIER ANALYZER and TFA may be purchased together for a combined price of $29.95 (Cassettes) and $37.95 (Diskettes).

REGRESSION I (Available for all computers) **Price: $19.95 Cassette**
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REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy; an automatic degree determination option; an extensive internal library of fitting functions; data editing; automatic data and curve plotting; a statistical analysis (e.g., standard deviation, correlation coefficient, etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

REGRESSION II (PARAFIT) (Available for all computers) **Price: $19.95 Cassette**
$23.95 Diskette

PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data and results may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

REGRESSION I and II may be purchased together for $36.95 (cassettes) and $44.95 (diskettes)

Availability

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. All programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II) and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard 8" CP/M floppy disks for systems running under MBASIC.

BUSINESS and UTILITIES

MAIL LIST II (North Star only) **Price: $21.95**

This many-featured program now includes full alphabetic and zip code sorting as well as file merging. Entries can be retrieved by user-defined code, client name or Zip Code. The printout format allows the use of standard size address labels. Each diskette can store more than 1100 entries (single density; over 2200 with double density systems)!

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An easy to use, line-oriented text editor which provides variable line widths and simple paragraph indexing. This text editor is ideally suited for composing letters and is quite capable of handling much larger jobs. Available for all computers.

FINDIT (North Star only) **Price: $19.95**

This is a three-in-one program which maintains information accessible by keywords of three types: Personal (e.g., last name), Commercial (eg: plumbers) and Reference (eg: magazine articles, record albums, etc). In addition to keyword searches, there are birthday, anniversary and appointment searches for the personal records and appointment searches for the commercial records. Reference records are accessed by a single keyword or by cross-referencing two or three keywords.

DFILE (North Star only) **Price: $19.95**

This handy program allows North Star users to maintain a specialized data base of all files and programs in the stack of disks which invariably accumulates. DFILE is easy to set up and use. It will organize your disks to provide efficient locating of the desired file or program.

COMPARE (North Star only) **Price: $12.95**

COMPARE is a single disk utility software package which compares two BASIC programs and displays the file sizes of the programs in bytes, the lengths in terms of the number of statement lines, and the line numbers at which various listed differences occur. COMPARE permits the user to examine versions of his software to verify which are the more current, and to clearly identify the changes made during development.

COMPRESS (North Star only) **Price: $12.95**

COMPRESS is a single-disk utility program which removes all unnecessary spaces and (optionally) REMark statements from North Star BASIC programs. The source file is processed one line at a time, thus permitting very large programs to be compressed using only a small amount of computer memory. File compressions of 20-50% are commonly achieved.

GRAFIX (TRS-80 only) **Price: $12.95 Cassette**
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This unique program allows you to easily create graphics directly from the keyboard. You "draw" your figure using the program's extensive cursor controls. Once the figure is made, it is automatically appended to your BASIC program as a string variable. Draw a "happy face", call it H$ and then print it from your program using PRINT H$! This is a very easy way to create and save graphics.

TIDY (TRS-80 only) **Price: $10.95 Cassette**
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TIDY is an assembly language program which allows you to renumber the lines in your BASIC programs. TIDY also removes unnecessary spaces and REMark statements. The result is a compacted BASIC program which uses much less memory space and executes significantly faster. Once loaded, TIDY remains in memory; you may load any number of BASIC programs without having to reload TIDY!

SIMULATIONS and EDUCATION

BLACK HOLE (Apple only) **Price: $14.95 Cassette**
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This is an exciting graphical simulation of the problems involved in closely observing a black hole with a space probe. The object is to enter and maintain, for a prescribed time, an orbit close to a small black hole. This is to be achieved without coming so near the anomaly that the tidal stress destroys the probe. Control of the craft is realistically simulated using side jets for rotation and main thrusters for acceleration. This program employs Hi-Res graphics and is educational as well as challenging.

VALDEZ (Available for all computers) **Price: $14.95 Cassette**
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A simulation of supertanker navigation in the Prince William Sound and Valdez Narrows. The program uses an extensive 256X256 element radar map and employs physical models of ship response and tidal patterns. Chart your own course through ship and iceberg traffic. Any standard terminal may be used for display.

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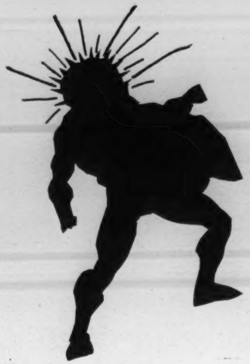
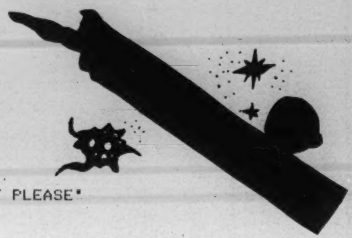
CIRCLE 136 ON READER SERVICE CARD

SUPERMAN



```
0010  DIM X$[10],N$[50],H$[100],C$[100]
0020  DIM L[18]
0030  B=1
0040  X7=C5=C=M=M3=Q7=W=D4=B7=K=0
0050  G2=100
0060  H=80
0070  D2=10
0080   FOR A5=1 TO 18
0090   L[A5]=0
0100   NEXT A5
0110  PRINT
0120  PRINT
0130  PRINT "THIS IS THE GAME OF SUPERMAN"
0140  PRINT "DO YOU WANT THE INSTRUCTIONS";
0150  INPUT X$
0160  PRINT
0170  IF X$="YES" THEN  GOSUB 1870
0180  Q=INT(RND(0)*18)+1
0190  L[Q]=1
0200  GOSUB 3700
0210  GOSUB 4460
0220  G1=G7
0230  PRINT "YOU HAVE A TOTAL OF ";G1;" CALORIES OF ENERGY"
0240  PRINT "TO DESTROY EACH CRIMINAL WITH, SO WATCH OUT."
0250  PRINT
0260  GOSUB 2780
0270  GOSUB 4110
0280   FOR D1=1 TO 9
0290   E[D1]=D1
0300   NEXT D1
0310   FOR D1=1 TO 9
0320   F[D1]=D2
0330   D2=D2+1
0340   NEXT D1
0350  PRINT
0360  PRINT "ENERGY LEFT-";G1;"LOCATION-";H$;"    HOURS LEFT-";H
0370  PRINT "COMMAND";
0380  INPUT A
0390  A=INT(A)
0400  IF A>0 AND A<6 THEN 430
0410  GOSUB 2660
0420  GOTO 350
0430  GOTO A OF 440,500,1010,1240,1420
0440  REM   *** X-RAY VISION ***
0450  IF K=1 THEN 4610
0460  GOSUB 2890
0470  H=H-1
0480  IF H=0 THEN 4500
0490  GOTO 350
0500  REM   *** FLYING ***
0510  PRINT "MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)";
0520  INPUT I
0530  IF I=0 OR I=1 THEN 560
0540  PRINT "JUST 1 OR 0 PLEASE"
0550  GOTO 500
0560  IF I=1 THEN 750
0570  IF C <> M THEN 610
0580  PRINT "YOU DO NOT EVEN KNOW IF THERE IS A CRIMINAL HERE IN THIS"
0590  PRINT "AREA, SO BEFORE YOU TRY TO MOVE INSIDE OF IT, FIND OUT FIRST"
0600  GOTO 470
0610  IF C<M THEN 690
0620  PRINT "HOW MANY PACES OVER TO THE ";X$;
0630  INPUT I
0640  M=M+I
0650  IF M=C THEN 1700
```



```
0660  GOSUB 3320
0670  IF D4=1 THEN 1780
0680  GOTO 470
0690  PRINT "HOW MANY PACES OVER TO THE ";X$;
0700  INPUT I
0710  M=M-I
0720  IF M=C THEN 1700
0730  GOSUB 3320
0740  GOTO 670
0750  C$=H$
0760  T=Q
0770  PRINT "HOW MANY AREAS OVER";
0780  INPUT I
0790  PRINT "TO THE LEFT OR RIGHT";
0800  INPUT X$
0810  IF X$="RIGHT" THEN 850
0820  IF X$="LEFT" THEN 960
0830  PRINT "INPUT JUST RIGHT OR LEFT PLEASE"
0840  GOTO 790
0850  Q=Q+I
0860  IF Q>18 THEN 880
0870  GOTO 910
0880  Q=18
0890  PRINT "YOU CAN NOT MOVE OVER THAT FAR ";X$;" SO YOU ARE OVER AS FAR"
0900  PRINT X$;" AS POSSIBLE"
0910  GOSUB 3700
0920  IF L[Q]=1 THEN 4540
0930  L[Q]=1
0940  K=0
0950  GOTO 470
0960  Q=Q-I
0970  IF Q<1 THEN 990
0980  GOTO 910
0990  Q=1
1000  GOTO 890
1010  REM   *** HEAT VISION ***
1020  IF K=1 THEN 4610
1030  R2=RND(0)
1040  IF C=M THEN 1210
1050  IF C>M THEN 1110
1060  IF M8<21 THEN 1120
1070  PRINT "YOU ARE NOT CLOSE ENOUGH TO ";N$;" TO USE YOUR HEAT VISION"
1080  PRINT "SO GET CLOSER TO HIM"
1090  GOSUB 3320
1100  GOTO 670
1110  IF C8>20 THEN 1070
1120  IF R2>.7 THEN 1170
1130  PRINT "WELL, YOU DID NOT HIT ";N$;", BUT ACTUALLY MISSED HIM BY"
1140  PRINT R2*100;"FEET.  WHAT A SHOT"
1150  G1=G1-200
1160  GOTO 1090
1170  PRINT "WHAT A SUPER SHOT, SUPERMAN, YOU NAILED ";N$
1180  GOSUB 3590
1190  IF W=1 THEN 1600
1200  GOTO 470
1210  PRINT "YOU DON'T KNOW WHETHER OR NOT THERE IS A CRIMINAL HERE IN THE"
1220  PRINT H$", SO BEFORE YOU SHOOT, FIND OUT"
1230  GOTO 470
1240  REM   *** SUPER STRENGTH ***
1250  IF K=1 THEN 4610
1260  IF C=M THEN 1210
1270  R2=RND(0)
1280  IF C>M THEN 1330
1290  IF M8<11 THEN 1340
1300  PRINT "YOU ARE NOT CLOSE ENOUGH TO ";N$;" TO USE YOUR SUPER"
1310  PRINT "STRENGTH, SO GET CLOSER"
1320  GOTO 1090
```

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CIRCLE 269 ON READER SERVICE CARD

```
1330  IF C8>10 THEN 1300
1340  IF R2>.5 THEN 1390
1350  PRINT "WHAT A ROUNDHOUSE PUNCH.  GOOD, BUT TOTALLY MISSED"
1360  PRINT N$
1370  G1=G1-100
1380  GOTO 1090
1390  PRINT "WHAT A PUNCH SUPERMAN.  IT KNOCKED OL ";N$;" BABY."
1400  PRINT "DEAD AS A DOORNAIL.  THAT IS ";B;"DOWN AND ";10-B;"TO GO"
1410  GOTO 1180
1420  REM   *** SUPER BREATH ***
1430  IF K=1 THEN 4610
1440  IF C=M THEN 1210
1450  R2=RND(0)
1460  IF C>M THEN 1510
1470  IF M8<31 THEN 1520
1480  PRINT "YOU ARE NOT CLOSE ENOUGH TO ";N$;" TO USE YOUR SUPER"
1490  PRINT "BREATH, SO TRY TO GET CLOSER"
1500  GOTO 1090
1510  IF C8>30 THEN 1480
1520  IF R2>.8 THEN 1570
1530  PRINT "WHAT BAD BREATH YOU HAVE.  IT DIDN'T EVEN COME CLOSE TO"
1540  PRINT "PUTTING ";N$;" AWAY"
1550  G1=G1-300
1560  GOTO 1090
1570  PRINT "WHAT A 'SUPER'MAN.  KNOCKED ";N$;" HEAD OVER"
1580  PRINT "HEELS WITH THAT BLAST.  THAT IS ";B;" DOWN AND ";10-B;" TO GO"
1590  GOTO 1180
1600  REM   *** ENDING STATEMENTS ***
1610  PRINT "CONGRADULATIONS.  IN DOING AWAY WITH "N$;" YOU DID AWAY WITH"
1620  PRINT "THE LAST SUPER CRIMINAL.  THE SUPER CRIMINAL'S PLAN "
1630  PRINT "CAN NOW NO LONGER GO INTO EFFECT, AND YOU HAVE SAVED THE WORLD"
1640  PRINT ""
1650  PRINT "DO YOU WISH TO TRY AGAIN";
1660  INPUT X$
1670  IF X$="YES" THEN 30
1680  PRINT "SUPERMAN SAYS GOOD-BYE"
1690  GOTO 4660
1700  PRINT
1710  PRINT
1720  PRINT "YOU HAVE MOVED YOURSELF RIGHT ON TOP OF ";N$
1730  PRINT "BECAUSE YOU WERE NOT READY FOR HIM, IT GAVE ";N$;" A CHANCE TO"
1740  PRINT "SLIP HIS GREEN KRYPTONITE DOWN YOUR BACK AND YOU HAVE LOST"
1750  PRINT "ALL OF YOUR ENERGY.  TOO BAD"
1760  D4=1
1770  GOTO 670
1780  PRINT
1790  PRINT "YOU HAVE LOST ALL OF YOUR ENERGY, AND BECAUSE YOU"
1800  PRINT "ARE NO LONGER ABLE TO PROTECT YOURSELF, ";N$
1810  PRINT "WAS ABLE TO OVERCOME YOU.  NOW THE SUPERCRIMINALS WILL BE"
1820  PRINT "ABLE TO CARRY OUT THEIR PLAN, AND EARTH IS DOOMED"
1830  PRINT "WAY TO GO BIG BOY.  THREE CHEERS FOR SUPER KLUTZ"
1840  PRINT
1850  PRINT "DO YOU WISH TO REDEEM YOURSELF AND TRY AGAIN";
1860  GOTO 1660
1870  REM   *** INSTRUCTIONS ***
1880  PRINT "HERE ARE THE INSTRUCTIONS:"
1890  PRINT
1900  PRINT "THERE ARE 10 SUPERCRIMINALS ON EARTH AND THEY HAVE"
1910  PRINT "A MASTER PLAN WITH WHICH THEY WANT TO TAKE OVER THE"
1920  PRINT "WORLD.  TO START IT MOVING, ONLY ONE OF THEM HAS TO PUSH THE"
1930  PRINT "BUTTON.  IT IS YOUR JOB AS SUPERMAN TO GET RID OF ALL"
1940  PRINT "10 SUPER CRIMINALS.  ALL 10 OF THEM ARE IN THE CITY OF"
1950  PRINT "METROPOLIS, SCATTERED THROUGHOUT 18 DIFFERENT AREAS"
1960  PRINT "WITH NO MORE THAN 1 IN AN AREA"
1970  PRINT
1980  PRINT "HIT RETURN TO CONTINUE";
1990  INPUT X$
```

```
2000  PRINT "HERE ARE THE AREAS:"
2010  PRINT
2020  B7=Q=1
2030   FOR V1=1 TO 6
2040    FOR V2=1 TO 3
2050    GOTO 3700
2060    PRINT H$;
2070    IF Q<18 THEN  PRINT " -> ";
2080    Q=Q+1
2090    NEXT V2
2100   PRINT
2110   NEXT V1
2120  B7=0
2130  PRINT
2140  PRINT "YOU CANNOT GO FURTHER LEFT THAN THE PARKING LOT AND NO"
2150  PRINT "FURTHER RIGHT THAN THE NUCLEAR PLANT.  IF YOU TRY TO, YOU WILL BE"
2160  PRINT "PLACED IN THE LAST ONE IN EITHER DIRECTION."
2170  PRINT
2180  PRINT "HIT RETURN TO CONTINUE";
2190  INPUT X$
2200  PRINT
2210  PRINT "TO CATCH AND DESTROY THE CRIMINALS, YOU HAVE FIVE DIFFERENT"
2220  PRINT "ABILITIES, DESCIBED AS FOLLOWS:"
2230  PRINT
2240  PRINT "1 - X-RAY VISION-USED TO SEE IF A CRIMINAL IS IN YOUR AREA,"
2250  PRINT "OR AFTER THAT, TO SEE APPROXIMATELY HOW FAR AWAY HE IS FROM YOU"
2260  PRINT "THE DISTANCE I TELL YOU IS NOT EXACTLY RIGHT, SO BE CAREFUL."
2270  PRINT "2 - FLYING-USED TO MOVE FROM ONE AREA TO ANOTHER, OR INSIDE OF"
2280  PRINT "THE AREA YOU ARE IN.  IF YOU LAND RIGHT ON THE CRIMINAL, YOU LOSE, SO WATCH OUT"
2290  PRINT "3 - HEAT VISION- CAN ONLY BE USED WHEN YOU ARE WITHIN 20 FEET"
2300  PRINT "OR LESS OF THE CRIMINAL, AND IT HAS A 30% CHANCE OF NAILING"
2310  PRINT "HIM.  IT TAKES UP 200 CALORIES OF ENERGY EACH TIME YOU USE IT"
2320  PRINT "4 - SUPER STRENGTH- CAN ONLY BE USED WHEN YOU ARE WITHIN 10 FEET"
2330  PRINT "OR LESS OF THE CRIMINAL, AND HAS A 50% CHANCE OF GETTING"
2340  PRINT "HIM.  IT TAKES 100 CALORIES OF ENERGY TO USE IT EACH TIME"
2350  PRINT "5 - SUPER BREATH- CAN ONLY BE USED WHEN YOU ARE WITHIN 30"
2360  PRINT "FEET OF THE CRIMINAL, AND HAS A 20% CHANCE OF NAILING HIM.  IT TAKES"
2370  PRINT "300 CALORIES OF ENERGY TO USE EACH TIME"
2380  PRINT
2390  PRINT "THE ABILITIES NUMBER 1 AND 2 ARE USED TO LOCATE THE CRIMINAL AND"
2400  PRINT "THE ABILITIES NUMBER 3,4,5 ARE USED TO NAIL THE CRIMINALS"
2410  PRINT
2420  PRINT "HIT RETURN TO CONTINUE";
2430  INPUT X$
2440  PRINT
2450  PRINT "THE WAY THAT THE CRIMINALS CAN GET YOU IS LIKE THIS:"
2460  PRINT "EACH ONE OF THE CRIMINALS HAS A POUND OF GREEN KRYPTONITE, WITH"
2470  PRINT "WHICH TO GET YOU WITH.  THE CLOSER YOU GET TO THEM, THE MORE ENERGY"
2480  PRINT "YOU LOSE.  IF YOU LOSE ALL OF YOUR ENERGY, YOU BECOME TO WEAK TO"
2490  PRINT "DEFEND YOURSELF AND THE CRIMINAL CAN OVERCOME YOU, AND YOU LOSE"
2500  PRINT "YOU HAVE A TOTAL OF 80 HOURS WITH WHICH TO STOP THEM FROM PUTTING"
2510  PRINT "THEIR PLAN INTO ACTION.  IF YOU TAKE LONGER, THEN THEY GET TO THE"
2520  PRINT "BUTTON, AND YOU LOSE ALSO. "
2530  PRINT
2540  PRINT "WHEN YOU NAIL THE CRIMINAL, ALL YOUR ENERGY IS RESTORED TO YOU"
2550  PRINT "AND YOU CAN KEEP ON GOING TO GET THE REST OF THE CRIMINALS."
2560  PRINT "IF YOU LEAVE AN AREA, YOU CAN'T RETURN TO IT,"
2570  PRINT "SO BE SURE TO GET THE CRIMINAL BEFORE YOU LEAVE, OR YOU CAN NEVER GET ALL TEN"
2580  PRINT
2590  PRINT "ONCE YOU HAVE NAILED A CRIMINAL, YOU HAVE TO MOVE ON, AND YOU CAN DO NOTHING"
2600  PRINT "ELSE UNTIL YOU DO SO"
2610  PRINT
2620  PRINT "HIT RETURN TO CONTINUE";
2630  INPUT X$
2640  PRINT
2650  RETURN
2660  REM   *** CHOICE OF ABILITIES ***
```

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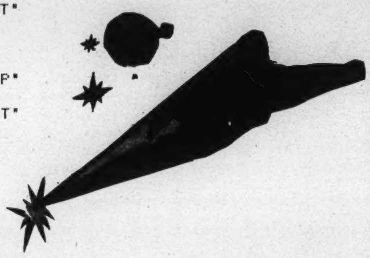
CIRCLE 217 ON READER SERVICE CARD

```
2670  PRINT
2680  PRINT "THESE ARE YOUR FIVE ABILITIES:"
2690  PRINT "1-X-RAY VISION"
2700  PRINT "2-FLYING"
2710  PRINT "3-HEAT VISION"
2720  PRINT "4-SUPER STRENGTH"
2730  PRINT "5-SUPER BREATH"
2740  PRINT "IF YOU INPUT ANY OTHER NUMBER THAN THESE FIVE, YOU WILL BE"
2750  PRINT "SENT BACK TO HERE.  TRY AGAIN"
2760  PRINT
2770  RETURN
2780  REM   *** PLACE THE CRIMINALS IN THEIR AREAS ***
2790   FOR R9=1 TO 10
2800   IF R9>1 THEN 2830
2810   N[R9]=INT(RND(0)*18)+1
2820   GOTO 2870
2830   N[R9]=INT(RND(0)*18)+1
2840    FOR R8=R9 TO 2 STEP -1
2850    IF N[R9]=N[R8-1] THEN 2830
2860    NEXT R8
2870   NEXT R9
2880  RETURN
2890  REM   *** WHERE IS THE CRIMINAL IN RELATION TO YOU ***
2900  IF C5 <> 10 THEN 3150
2910  IF X7>0 THEN 3130
2920  M=INT(RND(0)*200)+1
2930  C=INT(RND(0)*200)+1
2940  IF C>M THEN 2970
2950  IF C<M THEN 3050
2960  GOTO 2920
2970  C8=C-M
2980  X3=INT(RND(0)*20)+1
2990  C9=C8+2*(INT(RND(0)*X3)+1)
3000  X$="RIGHT"
3010  PRINT "X-RAY VISION TELLS YOU THAT YOU ARE APPROXIMATLEY ";C9
3020  PRINT "PACES AWAY FROM ";N$;" TO THE ";X$
3030  X7=1
3040  GOTO 3320
3050  M8=M-C
3060  X3=INT(RND(0)*20)+1
3070  M9=M8+2*(INT(RND(0)*X3)+1)
3080  X$="LEFT"
3090  PRINT "X-RAY VISION TELLS YOU THAT YOU ARE APPROXIMATELY ";M9
3100  PRINT "PACES AWAY FROM ";N$;" TO THE ";X$
3110  X7=1
3120  GOTO 3320
3130  IF C>M THEN 2970
3140  GOTO 3050
3150  REM   *** SUB-ROUTINE FOR X-RAY VISION ***
3160  IF Q>9 THEN 3210
3170   FOR X3=1 TO 10
3180   IF E[Q]=N[X3] THEN  C5=10
3190   NEXT X3
3200  GOTO 3240
3210   FOR X3=1 TO 10
3220   IF F[Q-9]=N[X3] THEN  C5=10
3230   NEXT X3
3240  IF C5 <> 10 THEN 3290
3250  PRINT "YOU HAVE CAUGHT ";N$;" SOMEWHERE IN THE ";H$
3260  PRINT "NOW ALL YOU HAVE TO DO IS FIND HIM"
3270  G1=G1-50
3280  RETURN
3290  PRINT "X-RAY VISION HAS DETECTED NO SUPER CRIMINAL HERE IN THE"
3300  PRINT H$;", SO MOVE ON"
3310  RETURN
3320  REM   *** SEE HOW MUCH ENERGY YOU HAVE LEFT ***
3330  IF G1 <= 0 THEN 3680
```

```
3340  IF C>M THEN 3360
3350  GOTO 3470
3360  C8=C-M
3370   FOR T0=190 TO 0 STEP -10
3380   IF C8>T0 AND C8 <= T0+10 THEN 3400
3390   GOTO 3430
3400   G1=G1-G2
3410   IF G1 <= 0 THEN  D4=1
3420   GOTO 3440
3430   G2=G2+35
3440   NEXT T0
3450  X$="RIGHT"
3460  GOTO 3570
3470  M8=M-C
3480   FOR T0=190 TO 0 STEP -10
3490   IF M8>T0 AND M8 <= T0+10 THEN 3510
3500   GOTO 3540
3510   G1=G1-G2
3520   IF G1 <= 0 THEN  D4=1
3530   GOTO 3550
3540   G2=G2+35
3550   NEXT T0
3560  X$="LEFT"
3570  G2=100
3580  RETURN
3590  REM   *** CHANGE CRIMINALS AND SEE IF SUPERMAN HAS WON ***
3600  IF B<10 THEN 3630
3610  W=1
3620  RETURN
3630  B=B+1
3640  G1=G7
3650  K=1
3660  C=M=X7=C5=W=0
3670  GOTO 4250
3680  D4=1
3690  GOTO 3580
3700  REM   *** NAMES OF THE AREAS ***
3710  IF Q>9 THEN 3920
3720  GOTO Q OF 3730,3760,3780,3800,3820,3840,3860,3880,3900
3730  H$="PARKING LOT"
3740  IF B7=1 THEN 2060
3750  RETURN
3760  H$="SUPER MARKET"
3770  GOTO 3740
3780  H$="JUNK YARD"
3790  GOTO 3740
3800  H$="GARBAGE DUMP"
3810  GOTO 3740
3820  H$="DAILY PLANET"
3830  GOTO 3740
3840  H$="SEWER"
3850  GOTO 3740
3860  H$="RIVER"
3870  GOTO 3740
3880  H$="OCEAN"
3890  GOTO 3740
3900  H$="AIRPORT"
3910  GOTO 3740
3920  GOTO Q-9 OF 3930,3950,3970,3990,4010,4030,4050,4070,4090
3930  H$="TRAIN STATION"
3940  GOTO 3740
3950  H$="RADIO STATION"
3960  GOTO 3740
3970  H$="T.V. STATION"
3980  GOTO 3740
3990  H$="AMUSEMENT PARK"
4000  GOTO 3740
```



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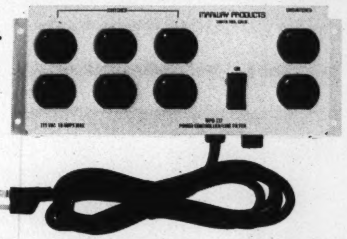

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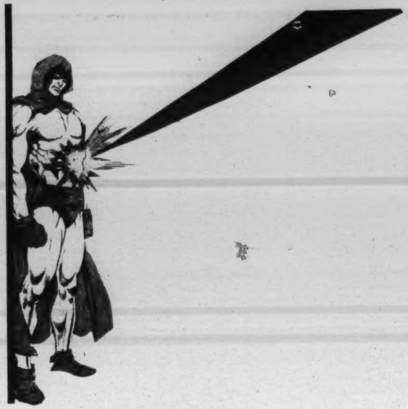
```
4010  H$="MOVIE THEATRE"
4020  GOTO 3740
4030  H$="APARTMENT BUILDING"
4040  GOTO 3740
4050  H$="DEPARTMENT BUILDING"
4060  GOTO 3740
4070  H$="BOOK STORE"
4080  GOTO 3740
4090  H$="NUCLEAR PLANT"
4100  GOTO 3740
4110  REM   *** CHOOSE CRIMINALS ***
4120  R8=INT(RND(0)*7)+1
4130  IF R8=3 OR R8=7 THEN 4150
4140  GOTO 4120
4150  R6=INT(RND(0)*10)+1
4160   FOR R9=1 TO 10
4170   A[R9]=R6
4180   R6=R6+R8
4190   IF R6>10 THEN 4210
4200   GOTO 4230
4210   R7=R6-10
4220   R6=R7
4230   NEXT R9
4240  REM   *** NAMES OF THE CRIMINALS ***
4250  GOTO A[B] OF 4260,4280,4300,4320,4340,4360,4380,4400,4420,4440
4260  N$="DOCTOR DOOM"
4270  RETURN
4280  N$="THE RED SKULL"
4290  RETURN
4300  N$="LEX LUTHER"
4310  RETURN
4320  N$="AMALEK"
4330  RETURN
4340  N$="BLACKROCK"
4350  RETURN
4360  N$="THE PENGUIN"
4370  RETURN
4380  N$="THE RIDDLER"
4390  RETURN
4400  N$="THE RAGMAN"
4410  RETURN
4420  N$="DARTH VADER"
4430  RETURN
4440  N$="THE KLINGON"
4450  RETURN
4460  REM   *** GET ENERGY ***
4470  G7=INT(RND(0)*5000)+1
4480  IF G7<4000 THEN 4470
4490  RETURN
4500  REM   *** TIME RUN OUT ***
4510  PRINT "YOUR TIME IS UP.  THE CRIMINALS HAVE GOTTEN TO THEIR"
4520  PRINT "SWITCH AND HAVE STARTED UP THEIR PLAN.  YOU HAVE LOST"
4530  GOTO 1830
4540  REM   *** REVISITING THE AREAS ***
4550  PRINT
4560  PRINT "YOU HAVE ALREADY VISITED THE ";H$;" SO YOU WILL HAVE TO MOVE ON"
4570  Q=T
4580  H$=C$
4590  PRINT
4600  GOTO 360
4610  REM   *** TRYING TO NOT MOVE AFTER NAILING A CRIMINAL ***
4620  PRINT
4630  PRINT "YOU HAVE JUST GOTTEN RID OF THE SUPER CRIMINAL IN THE ";H$
4640  PRINT "IT IS TIME TO GO ON"
4650  GOTO 750
4660  END
```



```
RUN
SUPERMAN


THIS IS THE GAME OF SUPERMAN
DO YOU WANT THE INSTRUCTIONS?YES

HERE ARE THE INSTRUCTIONS:

THERE ARE 10 SUPERCRIMINALS ON EARTH AND THEY HAVE
A MASTER PLAN WITH WHICH THEY WANT TO TAKE OVER THE
WORLD.  TO START IT MOVING, ONLY ONE OF THEM HAS TO PUSH THE
BUTTON.  IT IS YOUR JOB AS SUPERMAN TO GET RID OF ALL
10 SUPER CRIMINALS.  ALL 10 OF THEM ARE IN THE CITY OF
METROPOLIS, SCATTERED THROUGHOUT 18 DIFFERENT AREAS
WITH NO MORE THAN 1 IN AN AREA

HIT RETURN TO CONTINUE?
HERE ARE THE AREAS:

PARKING LOT -> SUPER MARKET -> JUNK YARD ->
GARBAGE DUMP -> DAILY PLANET -> SEWER ->
RIVER -> OCEAN -> AIRPORT ->
TRAIN STATION -> RADIO STATION -> T.V. STATION ->
AMUSEMENT PARK -> MOVIE THEATRE -> APARTMENT BUILDING ->
DEPARTMENT BUILDING -> BOOK STORE -> NUCLEAR PLANT

YOU CANNOT GO FURTHER LEFT THAN THE PARKING LOT AND NO
FURTHER RIGHT THAN THE NUCLEAR PLANT.  IF YOU TRY TO, YOU WILL BE
PLACED IN THE LAST ONE IN EITHER DIRECTION.

HIT RETURN TO CONTINUE?

TO CATCH AND DESTROY THE CRIMINALS, YOU HAVE FIVE DIFFERENT
ABILITIES, DESCIBED AS FOLLOWS:

1 - X-RAY VISION-USED TO SEE IF A CRIMINAL IS IN YOUR AREA,
OR AFTER THAT, TO SEE APPROXIMATELY HOW FAR AWAY HE IS FROM YOU
THE DISTANCE I TELL YOU IS NOT EXACTLY RIGHT, SO BE CAREFUL.
2 - FLYING-USED TO MOVE FROM ONE AREA TO ANOTHER, OR INSIDE OF
THE AREA YOU ARE IN.  IF YOU LAND RIGHT ON THE CRIMINAL, YOU LOSE, SO WATCH OUT
3 - HEAT VISION- CAN ONLY BE USED WHEN YOU ARE WITHIN 20 FEET
OR LESS OF THE CRIMINAL, AND IT HAS A 30% CHANCE OF NAILING
HIM.  IT TAKES UP 200 CALORIES OF ENERGY EACH TIME YOU USE IT
4 - SUPER STRENGTH- CAN ONLY BE USED WHEN YOU ARE WITHIN 10 FEET
OR LESS OF THE CRIMINAL, AND HAS A 50% CHANCE OF GETTING
HIM.  IT TAKES 100 CALORIES OF ENERGY TO USE IT EACH TIME
5 - SUPER BREATH- CAN ONLY BE USED WHEN YOU ARE WITHIN 30
FEET OF THE CRIMINAL, AND HAS A 20% CHANCE OF NAILING HIM.  IT TAKES
300 CALORIES OF ENERGY TO USE EACH TIME

THE ABILITIES NUMBER 1 AND 2 ARE USED TO LOCATE THE CRIMINAL AND
THE ABILITIES NUMBER 3,4,5 ARE USED TO NAIL THE CRIMINALS

HIT RETURN TO CONTINUE?

THE WAY THAT THE CRIMINALS CAN GET YOU IS LIKE THIS:
EACH ONE OF THE CRIMINALS HAS A POUND OF GREEN KRYPTONITE, WITH
WHICH TO GET YOU WITH.  THE CLOSER YOU GET TO THEM, THE MORE ENERGY
YOU LOSE.  IF YOU LOSE ALL OF YOUR ENERGY, YOU BECOME TO WEAK TO
DEFEND YOURSELF AND THE CRIMINAL CAN OVERCOME YOU, AND YOU LOSE
YOU HAVE A TOTAL OF 80 HOURS WITH WHICH TO STOP THEM FROM PUTTING
THEIR PLAN INTO ACTION.  IF YOU TAKE LONGER, THEN THEY GET TO THE
BUTTON, AND YOU LOSE ALSO.
```

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```
WHEN YOU NAIL THE CRIMINAL, ALL YOUR ENERGY IS RESTORED TO YOU
AND YOU CAN KEEP ON GOING TO GET THE REST OF THE CRIMINALS.
IF YOU LEAVE AN AREA, YOU CAN'T RETURN TO IT,
SO BE SURE TO GET THE CRIMINAL BEFORE YOU LEAVE, OR YOU CAN NEVER GET ALL TEN

ONCE YOU HAVE NAILED A CRIMINAL, YOU HAVE TO MOVE ON, AND YOU CAN DO NOTHING
ELSE UNTIL YOU DO SO

HIT RETURN TO CONTINUE?

YOU HAVE A TOTAL OF  4510     CALORIES OF ENERGY
TO DESTROY EACH CRIMINAL WITH, SO WATCH OUT.


ENERGY LEFT- 4510    LOCATION-PARKING LOT    HOURS LEFT- 80
COMMAND?1
YOU HAVE CAUGHT LEX LUTHER SOMEWHERE IN THE PARKING LOT
NOW ALL YOU HAVE TO DO IS FIND HIM

ENERGY LEFT- 4460    LOCATION-PARKING LOT    HOURS LEFT- 79
COMMAND?1
X-RAY VISION TELLS YOU THAT YOU ARE APPROXIMATELY  124
PACES AWAY FROM LEX LUTHER TO THE LEFT

ENERGY LEFT- 4115    LOCATION-PARKING LOT    HOURS LEFT- 78
COMMAND?2
MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)?0
HOW MANY PACES OVER TO THE LEFT?114

ENERGY LEFT- 3350    LOCATION-PARKING LOT    HOURS LEFT- 77
COMMAND?4
WHAT A ROUNDHOUSE PUNCH.  GOOD, BUT TOTALLY MISSED
LEX LUTHER

ENERGY LEFT- 2485    LOCATION-PARKING LOT    HOURS LEFT- 76
COMMAND?4
WHAT A PUNCH SUPERMAN.  IT KNOCKED OL LEX LUTHER BABY
DEAD AS A DOORNAIL.  THAT IS  1    DOWN AND  9    TO GO

ENERGY LEFT- 4510    LOCATION-PARKING LOT    HOURS LEFT- 75
COMMAND?2
MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)?1
HOW MANY AREAS OVER?1
TO THE LEFT OR RIGHT?RIGHT

ENERGY LEFT- 4510    LOCATION-SUPER MARKET    HOURS LEFT- 74
COMMAND?1
X-RAY VISION HAS DETECTED NO SUPER CRIMINAL HERE IN THE
SUPER MARKET, SO MOVE ON

ENERGY LEFT- 4510    LOCATION-SUPER MARKET    HOURS LEFT- 73
COMMAND?2
MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)?1
HOW MANY AREAS OVER?1
TO THE LEFT OR RIGHT?RIGHT

ENERGY LEFT- 4510    LOCATION-JUNK YARD    HOURS LEFT- 72
COMMAND?1
YOU HAVE CAUGHT THE KLINGON SOMEWHERE IN THE JUNK YARD
NOW ALL YOU HAVE TO DO IS FIND HIM

ENERGY LEFT- 4460    LOCATION-JUNK YARD    HOURS LEFT- 71
COMMAND?1
X-RAY VISION TELLS YOU THAT YOU ARE APPROXIMATELY  81
PACES AWAY FROM THE KLINGON TO THE LEFT
```

```
ENERGY LEFT- 3905    LOCATION-JUNK YARD    HOURS LEFT- 70
COMMAND?2
MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)?0
HOW MANY PACES OVER TO THE LEFT?70

ENERGY LEFT- 3140    LOCATION-JUNK YARD    HOURS LEFT- 69
COMMAND?4
WHAT A ROUNDHOUSE PUNCH.  GOOD, BUT TOTALLY MISSED
THE KLINGON

ENERGY LEFT- 2275    LOCATION-JUNK YARD    HOURS LEFT- 68
COMMAND?4
WHAT A PUNCH SUPERMAN.  IT KNOCKED OL THE KLINGON BABY
DEAD AS A DOORNAIL.  THAT IS  2    DOWN AND  8    TO GO

ENERGY LEFT- 4510    LOCATION-JUNK YARD    HOURS LEFT- 67
COMMAND?2
MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)?1
HOW MANY AREAS OVER?1
TO THE LEFT OR RIGHT?RIGHT

ENERGY LEFT- 4510    LOCATION-GARBAGE DUMP    HOURS LEFT- 66
COMMAND?1
X-RAY VISION HAS DETECTED NO SUPER CRIMINAL HERE IN THE
GARBAGE DUMP, SO MOVE ON

ENERGY LEFT- 4510    LOCATION-GARBAGE DUMP    HOURS LEFT- 65
COMMAND?2
MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)?1
HOW MANY AREAS OVER?1
TO THE LEFT OR RIGHT?LEFT

YOU HAVE ALREADY VISITED THE JUNK YARD SO YOU WILL HAVE TO MOVE ON

ENERGY LEFT- 4510    LOCATION-GARBAGE DUMP    HOURS LEFT- 65
COMMAND?2
MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)?1
HOW MANY AREAS OVER?1
TO THE LEFT OR RIGHT?RIGHT

ENERGY LEFT- 4510    LOCATION-DAILY PLANET    HOURS LEFT- 64
COMMAND?1
X-RAY VISION HAS DETECTED NO SUPER CRIMINAL HERE IN THE
DAILY PLANET, SO MOVE ON

ENERGY LEFT- 4510    LOCATION-DAILY PLANET    HOURS LEFT- 63
COMMAND?2
MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)?1
HOW MANY AREAS OVER?1
TO THE LEFT OR RIGHT?RIGHT

ENERGY LEFT- 4510    LOCATION-SEWER    HOURS LEFT- 62
COMMAND?1
YOU HAVE CAUGHT THE RIDDLER SOMEWHERE IN THE SEWER
NOW ALL YOU HAVE TO DO IS FIND HIM

ENERGY LEFT- 4460    LOCATION-SEWER    HOURS LEFT- 61
COMMAND?1
X-RAY VISION TELLS YOU THAT YOU ARE APPROXIMATLEY  59
PACES AWAY FROM THE RIDDLER TO THE RIGHT

ENERGY LEFT- 3800    LOCATION-SEWER    HOURS LEFT- 60
COMMAND?2
MOVE INSIDE OR OUT. (0-INSIDE    1-OUTSIDE)?0
HOW MANY PACES OVER TO THE RIGHT?49
```

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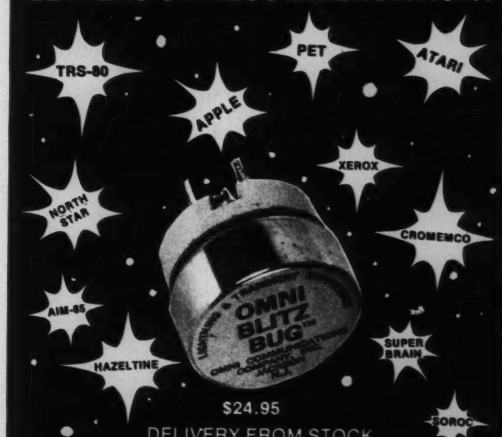

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BASIC
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GAMES
101 Great Games to Play on Your Home Computer. By yourself or with others. Each complete with programming and sample run. Edited by David H. Ahl

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All games come complete with program listing in Microsoft Basic, sample run and description. 200 pages softbound. [6C2] $7.95. TRS-80 Edition. 208 pages [6C4] $7.95.

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THE BEST OF
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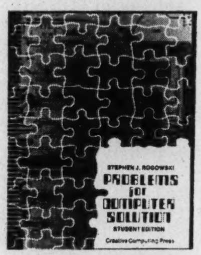
VOL 2 EDITED BY DAVID AHL

The Best of Creative Computing

The first two years of **Creative Computing** magazine have been edited into two big blockbuster books. **American Vocational Journal** said of Volume 1, "This book is the 'Whole Earth Catalog' of computers." [6A] Volume 2 continues in the same tradition. "Non-technical in approach, its pages are filled with information, articles, games and activities. Fun layout." —**American Libraries.** [6B] Each volume $8.95.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Fred D'Ignazio and Stan Gilliam. This is a delightful story told in words and full color drawings of Katie's adventures when she "falls" into a computer. In Katie's journey through the land of Cybernia she meets the Software Colonel, the Bytes, the Table Manager and even a ferocious Program Bug. Her journey parallels the path of a simple command through he stages of processing in a computer, thus explaining the fundamentals of computer operation to 4-10 year olds. Supplemental explanatory information is contained in the front and back end papers. 42 pp. hardbound $6.95. (12A)

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Recorded Live

Computer Music Record

A recording was made of the First Philadelphia Music Festival which is now available on a 12" LP record. It features eight different computer music synthesizers programmed to play the music of J.S. Bach, J. Pachelbel, Rimsky-Korsakov, Scott Joplin, Neil Diamond, Lennon & McCartney and seven others. The music ranges from baroque to rock, traditional to rag and even includes an historic 1963 computerized singing demonstration by Bell Labs. $6.00 [CR101].

The Best of BYTE

The Best of Byte

This is a blockbuster of a book containing the majority of material from the first 12 issues of Byte magazine. The 146 pages devoted to hardware are crammed full of how-to articles on everything from TV displays to joysticks to cassette interfaces and computer kits. But hardware without software might as well be a boat anchor, so there are 125 pages of software and applications ranging from on-line debuggers to games to a complete small business accounting system. A section on theory examines the how and why behind the circuits and programs, and "opinion" looks at where this explosive new hobby is heading. 386 pp softbound. $11.95 [6F]

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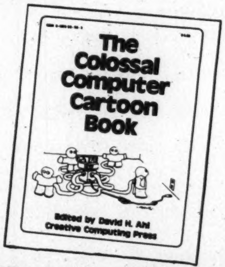
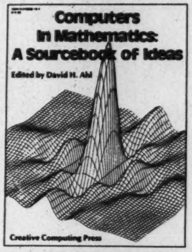


The Colossal Computer Cartoon Book

Edited by David H. Ahl. The best collection of computer cartoons ever is now in its second printing. There are fifteen chapters of several hundred cartoons about robots, computer dating, computers in the office, and much more. Keep the book with your reference works. When needed, the right cartoon can say it all for you. Provides hours of fun and comic insight. 120 pp. 8½ x 11" softbound. (6G) $4.95.



Computers in Mathematics: A Sourcebook of Ideas

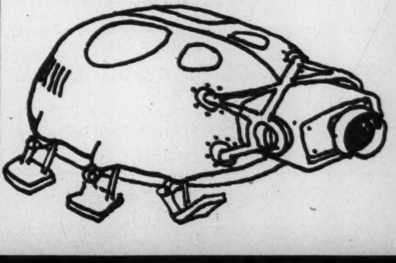
Here is a huge sourcebook of ideas for using computers in mathematics instruction. This large format book contains sections on computer literacy, problem solving techniques, art and graphing, simulations, computer assisted instruction, probability, functions, magic squares and programming styles.

One section presents over 250 problems, puzzles and programming ideas--more than is found in most "collection of problems" books.

Pragmatic, ready-to-use, classroom tested ideas are presented for everything from the most basic introduction to binary numbers to advanced techniques like multiple regression analysis and differential equations. Every item discussed has a complete explanation including flowcharts, programs and sample runs.

The book includes many activities that don't require a computer. And if you're considering expanding your computer facilities you'll find the section on how to select a computer complete with a microcomputer comparison chart invaluable.

Much of the material has appeared in **Creative Computing** but the back issues are no longer available. Hence this is your only source to this practical and valuable material. Edited by David H. Ahl, this mammoth 224-page softbound book costs only $15.95. (The individual issues, if they were available, would cost over $60.00). [12D]



The Impact of Computers on Society and Ethics: A Bibliography

REFERENCE

Gary M. Abshire.

Where is the computer leading us? Is it a menace or a messiah? What are its benefits? What are the risks? What is needed to manage the computer for society's greatest good? Will we become masters or slaves of the evolving computer technology? This bibliography was created to help answer questions like these. It contains 1920 alphabetical entries of books, magazine articles, news items, scholarly papers and other works dealing with the impact of computers on society and ethics. Covers 1948 through 1979. 128 pp hardbound. $17.95. [12E].

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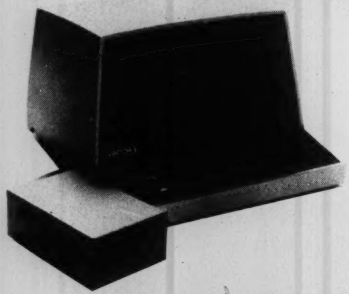


Vector Graphic Inc., has announced an intelligent, low cost entry-level computer system.

The VIP (Vector Intelligent Partner) is specifically designed to allow the user to grow into the full range of Vector products as individual demands warrant, rather than as price dictates.

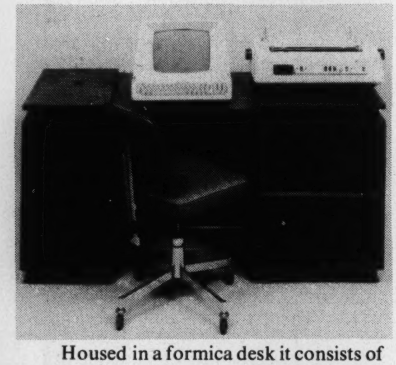
The VIP's upgradability derives from its use of the same core unit as in Vector's higher priced systems — the Vector 3, an integrated video console with built-in S-100 electronics. The single 315K minidisk drive is housed separately, allowing addition of up to three more identical drives, or replacement by Vector's 2 Megabyte "Dualstor" diskette unit, by its 30 Megabyte "Megastor" Winchester drive, or by any other drive units Vector may release. $3695.

Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91362. (213) 991-2302.

CIRCLE 272 ON READER SERVICE CARD

S-100 BUSINESS SYSTEM

Angel-1 is a small business system designed for word processing, payables and receivables, inventory, sales activity, check and expense register, name-address-appointments, client-patient records, library and special events. Also available are payroll, purchasing, general ledger, mailing list and customized programs.



Housed in a formica desk it consists of an S-100 mainframe, Z-80 CPU, 64K RAM, two single-sided, single-density 8" floppy disk drives, an 80 character x 24 lines CRT and a daisy-wheel printer. $7,995.

E & U Engel Consulting, 1719 So. Carmelina Ave., Los Angeles, CA 90025. (213) 820-4231.

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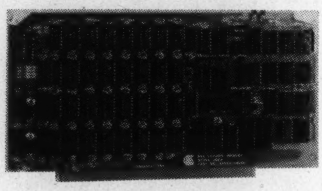
MEMORY

64K DYNAMIC RAM BOARD

California Computer Systems Model 2065 64K Dynamic RAM board gives the S-100 user 64K fast, reliable memory.



Conforming to the IEEE proposed standards for the S-100 bus, fast enough to require no Wait states with a 4 MHz CPU, and supporting front-panel operations, the 2065 is compatible with most S-100 systems.

In addition, it supports memory expansion to 512K through its bank-selection system. Used by Cromemco and others, the bank-select system allows the software-enabling of a bank through the output of a bank-select byte to the bank port. Berg jumpers on the 2065 allow selection of the board's bank and the bank port's address.

California Computer Systems, 250 Caribbean, Sunnyvale, CA 94086. (408) 734-5811.

CIRCLE 274 ON READER SERVICE CARD

EXPANDABLE BOARD FOR Z-80

QT Computer Systems has announced the Expandable + Dynamic Memory Board, which works with most Z-80 CPU boards including Cromemco Systems (ZPU-64K), S.D. Systems (SBC 100, 200 and Z-80 Starter Kit), SSM (CB2A), Jade (Big Z), QT (SBC+ 2/4), Ithaca Audio and North Star.

The Expandable + is available as a bare board, kit or assembled and tested unit. It supports 16K, 32K, 48K or 64K of memory, and uses a 3242 refresh chip with delay line, as well as a Z-80 refresh signal. Prices range from $70 for the bare board and manual to $625 for the 64K assembled

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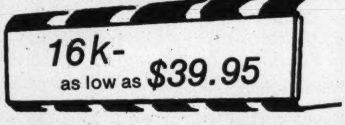

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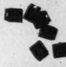
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Includes: HASH erases part of line on right of cursor EXPAND allows you to add things in the middle of your line. (like parentheses)
DELETE removes unwanted material from any part of the line.
(TAB) makes the cursor jump to the end of the line (not the screen)
(SHIFT) (TAB) makes it jump to the left side of the screen

This editor does limit you to 64 character but each BASIC command (such as PRINT, FOR, NEXT etc.) is automatically counted as one character-so you can fit much more in 64 characters.

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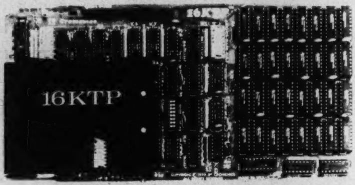
CIRCLE 275 ON READER SERVICE CARD

COLOR FOR CROMEMCO



Cromemco introduces two new two-port memory boards, the 16KTP and the 48KTP, for use with their Model SDI Color Graphics Interface.

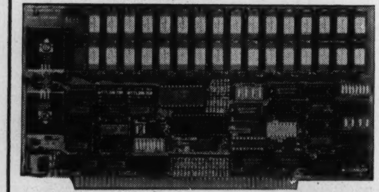
The SDI is a high resolution, color graphics interface which can be used to display images with up to 754 x 482 point resolution. This interface and the two-port memory, when used in conjunction with an RGB color monitor, turn any Cromemco computer into a highly sophisticated graphics system with features unparalleled in the industry.

The two-board color graphics interface is available for $595. The 16K two-port memory board is $795 and the 48K two-port memory board is $1785.

Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA (415) 964-7400.

CIRCLE 276 ON READER SERVICE CARD

S-100 COMPATIBLE 64K RAM MEMORY



Measurement systems & controls announces the addition of the DM6400 64K RAM module to its line of computer memory systems.

The DM6400 RAM modules are fully compatible with Cromemco, North Star, Processor Technology's Sol 20, Vector Graphics, Ithaca Audio, Mits, Marin Chips M9900 and most other 8080 and Z80A based S-100 systems. It will also run with most 8085, 3 MHz CPU boards.

Each S-100 compatible DM6400 contains a dynamic memory array, bus interface/control logic, on-board crystal timing, refresh oscillators, and voltage regulators.

The memory board is deselectable in 4K increments and has a power dissipation of 8 Watts maximum.

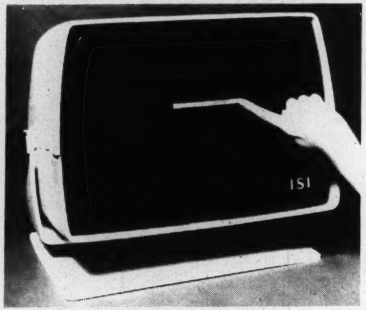
Measurement systems & controls, 867 North Main St., Orange, CA 92668. (714) 633-4460.

CIRCLE 277 ON READER SERVICE CARD

TERMINALS & I/O

TOUCH SENSITIVE CRT

The ISI Public Access Terminal features a rugged touch sensitive screen divided into multiple transparent, capacitive touch pads that simplify interactive dialog and eliminate the need for a keyboard.



Designed for unattended public use, all switches, adjustments, and cable connections are inaccessible to prevent tampering. Power and maintenance modes are key operated.

Equipped with a program selectable two-page display memory, the Z-80 based terminal incorporates a high resolution 15″ CRT and a 10 x 14 dot matrix to provide a large, easy-to-read display. Full upper and lower case ASCII character set is standard; customer specified fonts up to 240 characters are available. $2,800.

Interaction Systems, Inc., 24 Munroe St., Newtonville, MA 02160. (617) 244-9557.

CIRCLE 278 ON READER SERVICE CARD

LETTER-QUALITY PRINTER

Micromatic Corporation introduces the Micromatic 80, a TTL based interface designed to integrate the TRS-80 and many other small computers. It consists of an IBM Selectric computer printer combined with a compact interface.

The letter-quality printer has a speed of 8 to 9 CPS. The Micromatic 80 connects to the keyboard interface port or the expansion interface. All code conversions and timing software are contained within the Micromatic 80, and no special software is required. $795.

The Micromatic Corporation, 5747 West 85th St., Indianapolis, IN 46278. (317) 299-8614.

CIRCLE 279 ON READER SERVICE CARD

PARALLEL PRINTER INTERFACE FOR ATARI

Macrotronics, Inc. has introduced a parallel printer interface for the Atari line of microcomputers. It allows the Atari 400 or 800 to drive directly a parallel ASCII printer.

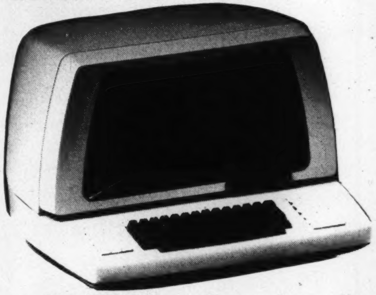
A cable assembly plugs into controller jacks 3 and 4 on the front of the computer. A short program is read into the computer from cassette; from then on, all printer data is directed to the parallel printer interface instead of the Atari serial port.

The program remains in memory until the computer power is turned off. The interface works equally well with Basic, DOS, or the Atari Assembler/Debug. $69.95.

Macrotronics, Inc., 1125 N. Golden State Blvd., Turlock, CA 95380. (209) 667-2888.

CIRCLE 280 ON READER SERVICE CARD

WORD PROCESSING QUALITY CRT



The WP2000 word processing quality CRT terminal from Industrial Micro Systems, Inc. features LSI microprocessor control with expandable control program, along with EPROM character generator and special function keys which make it adaptable for foreign languages and other special applications.

A high resolution video monitor provides a clear display utilizing a 9 x 13 dot matrix. Screen size is 12″ displaying 25 lines including a status line with user message capability.

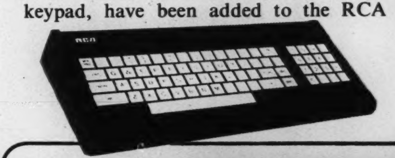
The WP2000 also features normal and reverse video, blinking fields, underlined fields and highlighted fields. Other special features include upper and lower case characters with descenders, 2-page memory, automatic self test, pen interface, and printer port.

Industrial Micro Systems, Inc., 628 Eckhoff St., Orange, CA 92668. (714) 978-6966.

CIRCLE 281 ON READER SERVICE CARD

SERIAL OUTPUT ASCII ENCODED KEYBOARDS

Two 128-character ASCII encoded keyboards with asynchronous serial output, the VP-606 with a 58-key typewriter format and the similar VP-616 with an additional 16-key calculator-type keypad, have been added to the RCA MicroComputer Products line.



Professional-quality keyboards suitable for demanding environments, the units incorporate high-technology, flexible-membrane key switches with a light positive activation pressure. Contact life is rated at greater than five million operations. Units are priced at $46. for parallel output with case and $65. for serial output with case.

MicroComputer Products Marketing, RCA, New Holland Ave., Lancaster, PA 17604. (717) 697-7661.

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PERIPHERALS

FULL-COLOR HARD COPY

Full-color hard copy reproductions of computer graphics are available with the introduction of the Videoprint Systems from Image Resource.

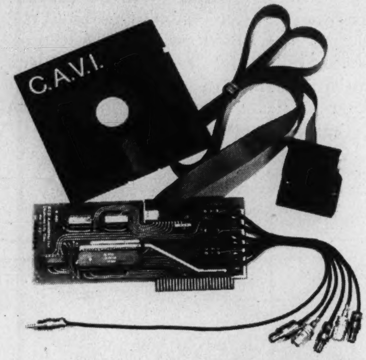
The Videoprint 3000 series, priced from $2,990 to $3,550, is used as a hard copy computer peripheral for the educational, small business, and personal computer graphics markets. The Videoprint 5000 series, priced at $5,950, is a higher performance system, equipped with more flexibility for the industrial and commercial computer graphics user.

Both systems are self-contained and fully automatic for minimizing optical distortion, with color, brightness, and exposure adjustments under microprocessor control. Both produce 4″ x 5″ hard copy prints in seconds. Also available are Polaroid SX-70 and 35mm sizes.

Image Resource, 2260 Townsgate Rd., Westlake Village, CA 91361. (805) 496-3317.

CIRCLE 284 ON READER SERVICE CARD

INTERACTIVE VIDEO INTERFACE



The C.A.V.I. Model 400 from BCD Associates, Inc. is a single board video tape controller for Apple II microcomputers. The system hardware/software permits precise video tape positioning by counting pulses from the control track of the tape.

The interface contains a video/audio switcher to allow alternate display of computer-generated or taped video on a single monitor. The system will control industrial type VHS, Beta, and ¾″ video recorder/players. No modifications to the computer or the VTR are required.

Basic software is included on disk to allow the user to "Search To" the beginning of a video scene and "Play Until" the end of that scene. Starting and ending frame numbers of each scene may be saved to the disk for future reference. $495.

An advanced Computer Assisted Instruction software system is available on a separate disk. "The Instructor" allows persons with no computer expertise to create and modify C.A.I. lessons and video tape logs. $295.

BCD Associates, Inc., 1216 N. Blackwelder Ave., Oklahoma City, OK 73106. (405) 524-7403.

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DIGITIZER FOR APPLE

Computer Station offers a high speed binary video digitizer for the Apple II. The Dithertizer II is a peripheral board for the Apple II which utilizes a video camera with external sync to load the high resolution page of the Apple II with any image that can be captured with the video camera.

The Dithertizer II was designed as a frame grabber, DMA type, digitizer to require only one frame or 1/60th of a second to capture a binary image (140 nanoseconds per pixel).

Software is included to build dithered (pseudo gray scale via half tones) images from multiple binary images and to capture image intensity contours using image subtraction. $300.

Computer Station, 12 Crossroads Plaza, Granite City, IL 62040. (618) 452-1860.

CIRCLE 286 ON READER SERVICE CARD

BAR CODE READER FOR APPLE

Advanced Business Technology, Inc. announces the BarWand, the latest addition to its line of Apple peripherals.

The BarWand is a precision electro-optical device which reads programs and data when the user guides it along a line of bar code. When bar code has been successfully entered, a scan tone sounds, indicating the last line of data was correctly read.

The wand contains a light-emitting diode and a photosensor that detects changes in the light reflected from the material being scanned. $195.

Advanced Business Technology Inc., 12333 Saratoga-Sunnyvale Rd., Saratoga, CA 95070. (408) 446-2013.

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Both games for $32.50.

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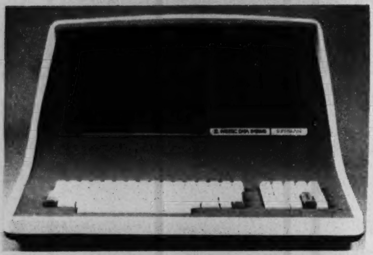

32K or 64K (Double or Quad Density units available). Uses two Z-80 CPU's. Commercial-type terminal with 12" monitor. Dual double density minifloppies. Over 350 kilobytes of storage (twice that with quad density drives). Two serial RS232 ports, I/O ports standard. Expandable with optional S-100 S-100 interface. Comes with CP/M™ 2.2 operating system. MiniMicroMart includes BASIC interpreter and can supply a wide range of CP/M Development and Application software.

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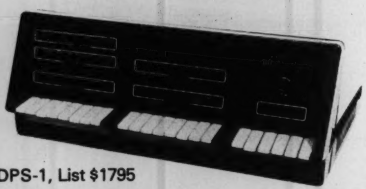

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The new Series II CPU Board features a 4 MHz Z-80A CPU and a full-feature front panel. 20-slot actively terminated motherboard, with 25 amp power supply (50/60 Hz operation, incl. 68 cfm fan).

COMPLETE SYSTEM with InterSystem 64K RAM, I/O Board w/priority interrupt and double density disk controller board. Full 1-year warranty, List $3595

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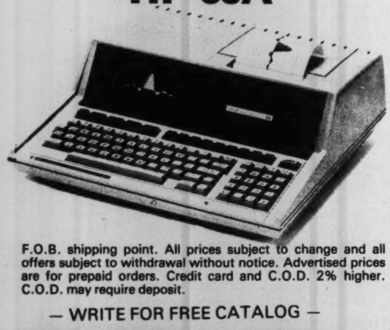

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SYSTEMS SOFTWARE

SYSTEMS

ZDM is a **Z-80 debugger** and monitor designed to operate within the CP/M environment. It is patterned after and intended to replace the CP/M module DDT for Z-80 and 8080 software development and general Z-80 and 8080 program debugging. $30. RD Software, 1290 Monument St., Pacific Palisades, CA 90272. (213) 454-8270.

CIRCLE 288 ON READER SERVICE CARD

Digital Research has introduced **CP/M-86**, an operating system for Intel 8086/8088-based microcomputers. The file format of CP/M release 2 has been retained for compatibility. Also available is an enhanced version of the **PL/I-80 Compiler** and Run-Time System. PL/I-80 1.1 features an overlay system which can produce a "menu-driven" application program, where each user command references an overlay module. Digital Research, P.O. Box 597, 801 Lighthouse Ave., Pacific Grove, CA 93950. (408) 649-3896.

CIRCLE 289 ON READER SERVICE CARD

Micro Video **Monitor for the Interact** gives users access to the machine language capability of the computer. It allows combined Microsoft Basic and machine code programming. $19.95. Micro Video, P.O. Box 7357, 204 E. Washington St., Ann Arbor, MI 48107. (313) 996-0626.

CIRCLE 290 ON READER SERVICE CARD

Accel2 for the TRS-80 is a double-optimising compiler which produces compact machine code translations of selected Disk Basic statements and functions in all variable types. $88.95. Allen Gelder Software, Box 11721 Main Post Office, San Francisco, CA 94101.

CIRCLE 291 ON READER SERVICE CARD

NEWDOS/80 for the TRS-80 is an enhancement which extends the capabilities of NEWDOS 2.1. It is designed for the sophisticated user and professional programmer. $149. Apparat, Inc., 4401 S. Tamarac Pkwy., Denver, CO 80237. (303)741-1778.

CIRCLE 292 ON READER SERVICE CARD

Dynasoft **Pascal**, a cassette-based Pascal program development system, is a compact p-code implementation of a Pascal subset. The package includes the compiler, interpreter, and line-oriented editor and will run on a 16K Apple II or Apple II Plus. $50. Dynasoft Systems, Ltd., P.O. Box 51, Windsor Junction, Nova Scotia, Canada, BON 2VO.

CIRCLE 293 ON READER SERVICE CARD

LANGUAGES

Softronics has released version 2.3 of the **APL** language for computers using the CP/M operating system. A minimum of a 48K CP/M system is required. $350. Softronics, 36 Homestead Lane, Roosevelt, NJ 08555.

CIRCLE 294 ON READER SERVICE CARD

Forth Version 1.7 for the Apple includes the Forth Interest Group programming language plus development aids and a tutorial manual. It also features a structured macro assembler which allows the user to create machine-language subroutines. $140. Cap'n Software, P.O. Box 575, San Francisco, CA 94101.

CIRCLE 295 ON READER SERVICE CARD

BPilot is a version of Pilot for the TRS-80 which is compatible with Basic and allows the user to intermingle Basic and Pilot instructions in his program. $24.95. CAMI, P.O. Box 2030, Goleta, CA 93018.

CIRCLE 296 ON READER SERVICE CARD

Appilot II adds hi-resolution graphics, speech and the ability to accept student input from an optional light pen to the capabilities already included in the original Appilot. Designed to allow educators and courseware developers to write lessons using text, color graphics and sound, the language will run on an Apple II or Apple II Plus with one disk drive, Integer Basic and 48K. $99.95. Muse Software, 330 North Charles St., Baltimore, MD 21201. (301) 659-7212.

CIRCLE 297 ON READER SERVICE CARD

The **Waterloo Basic** software package for the PET which incorporates structured programming techniques and the constructs necessary for effective instruction in programming style and discipline. The enhancements are coded in 6502 machine language and reside in 2716 EPROM. The package is compatible with Basic V.2 and Basic V.4 for 40-column and 80-column PETs. Computer Systems Group, University of Waterloo, Waterloo, OT, Canada N2L 3G1.

CIRCLE 298 ON READER SERVICE CARD

DATA BASE MANAGEMENT SYSTEMS

Omnifile is an in-memory database program with sorting, formatting and computational features for PET or CBM computers with at least 16K of memory. Cassette, $30; disk, $36. Channel Data Systems, 5960 Mandarin Ave., Goleta, CA 93017. (805) 964-6695.

CIRCLE 299 ON READER SERVICE CARD

Filemaster II for the Apple II includes four Applesoft programs: File Designer, a menu-driven guide for developing the structure of the information; Search and Retrieval, for entering data and retrieving records; Sort Information, which provides the required input for use with the Single Disk Sort by Datacope; and File Converter, which converts Filemaster I files. It requires 48K, Applesoft in ROM and a disk drive. $99.50. Rainbow Computing, Inc., Garden Plaza Shopping Center, 9719 Reseda Blvd., Northridge, CA 91324. (213) 349-5560.

CIRCLE 301 ON READER SERVICE CARD

APPLICATIONS SOFTWARE

BUSINESS

Technology Systems announces an integrated **business software** system which includes accounts receivable, accounts payable, order entry, invoicing, payroll and name/address. The system is designed to run on any 8080/Z80 based computer using North Star Basic. The program modules are available on single, double or quad density 5 ¼" or 8" floppy disk or a hard disk. Technology Systems, 208 Greenwood Ave., Bethel, CT 06801.

CIRCLE 302 ON READER SERVICE CARD

Sales is a program for the TRS-80 that prints invoices, sales slips, packing slips and address labels using standard blank forms. $39.95. **Sales Status** allows the user to generate sales reports, sales tax summaries and customer files or mailing lists from files created by the Sales program. $39.95. A 32K disk system and line printer are required. Bluebird's Inc., 2267 23rd St., Wyandotte, MI 48192. (313) 285-4455.

CIRCLE 303 ON READER SERVICE CARD

Mail 80 is a disk-based mailing system for the TRS-80 Model II. All names may be contained in one file or separate files may be maintained for different groups. $69.95. Mark Gordon Computers, 15 Kenwood St., Cambridge, MA 01239.

CIRCLE 304 ON READER SERVICE CARD

Small Business Systems Group announces an **Invoicing System** designed to run in conjuction with the existing SBSG Osborne Accounts Receivable systems for the TRS-80 Models I and II. Small Business Systems Group, Inc., 6 Carlisle Rd., Westford MA 01886. (617) 692-3800.

CIRCLE 305 ON READER SERVICE CARD

The **Estimator** is a computerized worksheet which allows the user to enter item titles, material quantities, material unit costs, hours of labor and miscellaneous items. Totals are produced for both the individual items and the estimate as a whole. Prices range from $40 to $95. The **Framing Calculator**, estimates material quantities and hours of labor required for general wood frame construction. Prices range from $125 to $150. Both programs are avilable for TRS-80 Models I and II, CP/M on Micropolis and Standard 8" CP/M. Mendocino Software, P.O. Box 1564, Willits, CA 95490. (707) 485-7893 or (707) 459-9130.

CIRCLE 306 ON READER SERVICE CARD

GL, a **general ledger** program is the heart of an integrated accounting package for the TRSDOS 1.2 on TRS-80 Model II. Features include double entry accounting, ISAM, and 80-column screen display. It is interactive and menu-driven. $129. Also available for the TRS-80 Model II is PR, a **payroll** system which calculates payroll for hourly, salaried and commissioned employees while maintaining monthly, quarterly and yearly totals. $129. MicroArchitect, 96 Dothan St., Arlington, MA 02174. (617) 643-4713.

CIRCLE 307 ON READER SERVICE CARD

A **Job Costing** option has been added to the Microcomputer Consultants General Ledger System. Designed for CP/M systems, it provides a job analysis report, showing the ratio of costs to income by job; job budget report, comparing actual expenditures with the amount budgeted; and class analysis report, showing costs by classification across all jobs. $600. Microcomputer Consultants, P.O. Box T, 1623-A Fifth St., Davis, CA 95616. (916) 756-8104.

CIRCLE 308 ON READER SERVICE CARD

SoftCare is a series of programs designed to automate the billing and recordkeeping functions in a medical office of

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High Performance
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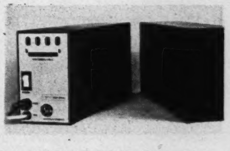

The SIRIUS SYSTEMS 80+ Series of Floppy Disk add-ons are designed to provide unmatched versatility and performance for your TRS-80*. Consisting of four different add-ons, there is a 80+ Series Floppy Disk Drive to meet your needs.

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- *Single/Double Density operation*
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The **SIRIUS 80+1** -a single sided, 40 track Drive. Offering 5 more tracks than the Radio Shack model, it cost $120 less. Formatted data storage is 102K/204K Bytes Single/Double Density.
SIRIUS 80+1 .... **$379.95**
The **SIRIUS 80+2** is a dual sided, 80 track (40 per side) Disk Drive. It appears to the TRS-80* as TWO 40 track drives yet **COST LESS THAN HALF THE PRICE!** Even greater savings result since data is recorded on both sides of the media instead of only a single side. This unit may require the SS Standard cable. Formatted data storage is 204K/408K Bytes Single/Double Density.
SIRIUS 80+2 .... **$449.95**
The **SIRIUS 80+3** - a single sided, 80 track Drive. Offering 2⅓ times the storage of a standard Radio Shack Disk Drive, the 80+3 greatly reduces the need for diskettes correspondingly. Additionally, because of the increased storage and faster track-to-track access time, the 80+3 allows tremendously increased throughput for disk based programs! The 80+3 includes SIRIUS's TRAKS-PATCH on diskette (for use with 96 tpi drives). Formatted data storage is 204K/408K Bytes Single/Double Density.
SIRIUS 80+3 .... **$499.95**
The **SIRIUS 80+4** -a dual sided, 160 track (80 per side) 5¼" monster! The ultimate in state-of-the-art 5¼" Floppy Disk Technology, the 80+4 is seen by the TRS-80* as two single sided disk drives. Thus, in terms of capacity, one 80+4 is equivalent to 4⅔ standard Radio Shack drives — at a savings of over 73% (not to mention diskettes!!!). (With a double density converter the available memory is huge!) The 80+4 (a 96 tpi drive) includes TRAKS-PATCH on diskette and may require the SS Standard cable. Formatted storage is 408K/816K Bytes Single/Double Density.
SIRIUS 80+4 .... **$649.95**

All 80+ Series Floppy Disk add-ons operate at 5ms track-to-track but are Expansion Interface limited to 12ms for the TRS-80*

**TRS-80© of Tandy Corp.*

ACCESSORIES

SS Standard 2 Drive Cable	**$29.95**
NEWDOS/80-Sophisticated Operating System for the TRS-80* from Apparat	**$149.95**

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NEWDOS/80, SIRIUS 80+4, and Two Drive Cable	**$749.95**
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MPI 91 (Single Head/80 tracks) 250K/500K Bytes Single/Double Density**	**$399.95**
MPI 92 (Dual Head/160 tracks (80/side)) 500K/1000K Bytes Single/Double Density**	**$524.95**
MPI Technical Manual	**$6.95**

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QUME Technical Manual	**$6.95**
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Connector Set #4 (AC and DC)	**$2.95**

TFORTH! -what it has to offer YOU!

TFORTH is a procedural FORTH type language which specifies a process rather than a desired result. Designed to run on the TRS-80*, TFORTH is a very powerful tool by itself or used in conjunction with Assembly Programming. A rich set of WORDS come with TFORTH and many features considered as "extra with other FORTH languages are standard with TFORTH. These features include:

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- *Macro Assembler*
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- *Super Graphics Capabilities*
- *Sophisticated User Functions*
- *140 Page User's Manual*
- *Virtual memory*
- *Interpreter*
- *Compiler*
- *Produces CMD Files*
- *Expandable*
- *And many, many other features*

TFORTH from SIRIUS comes on diskette complete for the TRS-80* with as little as 16K of memory and a single Disk Drive.
TFORTH **$129.95**

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CIRCLE 236 ON READER SERVICE CARD

one to thirty physicians. The system operates on any Z-80, 6502 or DEC 11/03 computer which runs UCSD Pascal Version 2.0, and requires 27K of usable RAM. Professional Business Software, 119 Fremont St., San Francisco, CA 94105. (415) 546-1596.

CIRCLE 311 ON READER SERVICE CARD

Property Management, designed for use in the real estate business, produces reports which track all forms of income property. **Financial Analysis** provides cash flow analysis, tax analysis and information on tax deferred exchanges for income property. Both programs run under CP/M. American Software Corporation, P.O. Box 427, Mill Valley, CA 94941. (415) 381-1600.

CIRCLE 312 ON READER SERVICE CARD

Tax/Saver is an interactive program designed to help the taxpayer prepare his or her return. If there is more than one way to prepare the return, the program allows the user to compare the results and choose the most advantageous one. It is avilable for TRS-80 Level II 16K on three cassettes for $65, or for a 32K TRS-80 with two disk drives on four diskettes for $80. Micromatic Programming Co., P.O. Box 158, Georgetown, CT 06829. (203) 544-8777.

CIRCLE 313 ON READER SERVICE CARD

MenuManager was written by a restaurateur to monitor food costs, predict sales trends and calculate the estimated profit of a restaurant. Using two 5 ¼", double-density diskettes, the program can store 1200 recipes, 100 menu items and 100 raw food items. Microsource, 1425 West 12th PL., Tempe, AZ 85281. (602) 894-9247.

CIRCLE 314 ON READER SERVICE CARD

CDS Corporation announces **Mail List**, a user-oriented program which stores up to 1050 records on each disk. Mailing labels can be sorted alphabetically, by zip code, by status (active or inactive), or by a six-character utility field designated by the user. The program runs on a Commodore CBM 16K or 32K computer with CBM 2040 disk drives and a CBM or ASCII printer. $95. CDS Corporation, 695 East Tenth North, Logan, UT 84321. (801) 753-6990.

CIRCLE 315 ON READER SERVICE CARD

MDMS Planner is a desk top business planner which provides financial and business information to users of Ohio Scientific computers. Features include: unlimited model size, formatted report generation, English-like calculation rules, and a plotting capability. The system is compatible with Ohio Scientifics MDMS data base manager. Ohio Scientific, 1333 S. Chillicothe Rd., Aurora, OH 44202. (800) 321-6850.

CIRCLE 316 ON READER SERVICE CARD

National Software Marketing announces the release of a system for the **management of apartment and condominium complexes**. The system includes three modules: Tentroll ($200); Maintenance, Security Deposit and Three-day Notice ($100); and General Ledger and Accounts Payable ($145). It is written in Basic for the TRS-80 Model II. National Software Marketing, Inc., P.O. Box 6195, Hollywood, FL 33021. (305) 625-6062.

CIRCLE 349 ON READER SERVICE CARD

Configurable Business System provides **customized accounting** systems, including payables, receivables, inventory control and order entry. It features a comprehensive report generator for producing invoices, purchase orders, re-order reports, special reports and mailing labels; the ability to produce and read ASCII data files; menu-chaining; and batched updating. The system requires a 48K CP/M compatible system and at least 200K bytes of mass disk storage. $395. Lifeboat Associates, 1651 Third Ave., New York, NY 10028 (212) 860-0300.

CIRCLE 317 ON READER SERVICE CARD

SMALL SOFTWARE SYSTEM **PRODUCTS FOR THE TRS-80** SMALL SOFTWARE SYSTEM

NEW!

PENMOD - $19.95. Adapts Disk-Pencil to Radio Shack lower case modification. Also adds single page printing and several other new features.

SCRIPMOD - $14.95. Add TRS232 print driver, or add handshake/linefeed control to RS-232-C driver in Radio Shack's SCRIPSIT (disk version only).

WHISTLER: HOME CONTROLLER INTERFACE - $34.95. New hardware product that controls lights, appliances, computer peripherals, darkroom timers and other 115 volt devices anywhere in your house! Software controlled by cassette cable. Use with Sears or BSR Home Control System with ultrasonic option. Assembled, tested, self-contained, and includes Basic software.

UTILITIES

RSM-2: MACHINE LANGUAGE MONITOR FOR 16K TRS-80'S - $26.95
RSM-2D: THREE VERSIONS OF RSM-2 FOR DISK SYSTEMS - 29.95
RSM-2 RELOCATOR: PUT RSM-2/2D ANYWHERE IN MEMORY - 9.95

Machine Language monitors with Z-80 disassembler! HEX and ASCII memory dumps; EDIT, MOVE, EXCHANGE, VERIFY, FILL, ZERO, TEST, or SEARCH memory, read/write SYSTEM tapes, enter BREAKPOINTS, PRINT with TRS232 or Centronics, read/write disk sectors directly! RSM-2 tape loads at top of 16K LEVEL I or II; RSM-2D disk includes 3 versions for 16K, 32K and 48K.

DCV-1: CONVERT SYSTEM PROGRAMS TO DISK FILES -$14.95 Execute Adventure, Air Raid, RSL-1, ESP-1, T-BUG, etc. from disk, even if they interfere with TRSDOS! New version works with TRSDOS 2.3.

BASIC-1P: LEVEL-1 BASIC WITH PRINTING! - $19.95. Run any LEVEL-I BASIC program on your 16K Level-2. PLUS LPRINT and LLIST with our TRS232 or Centronics. Furnished on tape; can be used from disk.

MACHINE LANGUAGE GAMES

AIR RAID, BARRICADE or **RSL-1: - $10.00** each, all 3 for **$25.00**

AIR RAID: A super shooting gallery; our most popular game. Ground based missile launcher shoots high speed aircraft! Hours of fun!

BARRICADE: "BREAKOUT" for the TRS-80! Break through 5 walls with high-speed ball and keyboard controlled paddle! 96 different options!

RSL-1: Enter patterns with repeating keyboard! Save patterns on tape (4 furnished). Play John Conway's LIFE. FAST - about 1 second per generation!

SMALL SYSTEM SOFTWARE ▬ P.O. BOX 366 ● NEWBURY PARK, CA 91320

PROFESSIONAL SOFTWARE

NEW! ELECTRIC PENCIL-IIB FOR MODEL-II. Super Pencil version runs under TRSDOS or CP/M. Automatic centering, dynamic print formatting, single-page printing,etc. Buffered keyboard eliminates missed characters at line ends! Diablo, NEC, Qume versions include bold face print, variable pitch, & more!
TRSDOS PENCIL: Standard printer - $325; Diablo, NEC, Qume (specify) - $350
CP/M PENCIL: Standard printer - $275; Diablo, NEC, Qume (specify) - $300

ELECTRIC PENCIL FOR MODEL-I: TAPE-$99.95, DISK-$150.00. Popular video editor for creating and saving text files. Prints formatted copy with right justification, page titling & numbering, etc. Upper case only, or lower case with modification. Requires at least 16K.

RSMII: ENHANCED RSM MONITOR FOR THE MODEL-II - $39.95. Relocatable version of RSM-2D plus screen editor for modifying either memory or disk sectors in both Hex and ASCII, split screen scrolling, and formatted serial or parallel printing. Sold on self-booting disk; directions to save as TRSDOS file.

CP/M OPERATING SYSTEM: MODEL-I - $145.00; MODEL-II - $170.00. The 8080/Z80 "Software Bus" for TRS-80's. Model-I includes TRS232 and RS-232-C software. Model-II supports single and double density disks, and reads TRSDOS files. Many unique utilities included in both versions!

PRINTER SUPPORT

TRS232 PRINTER INTERFACE - $59.95 Assembled & tested printer interface for RS232 or 20-mil current loop printers. Expansion interface not required. Print from level-II BASIC, CP/M, BASIC-1P, ELECTRIC PENCIL, etc. Standard cassette software included. Add $2.00 for shipping.

TRS232 "FORMATTER" SOFTWARE PACKAGE - $14.95. Adds page and line length control, printer pause, "smart" line termination, etc. to TRS232.

RSM232: Adds RS-232-C capability to RSM-2/2D monitors - **$14.95**
PEN232: RS-232-C for cassette version Electric Pencil - **$14.95**
EDT232: TRS232 and RS-232-C for tape version of EDTASM - **$14.95**

OTHER PRODUCTS FOR THE TRS-80

ESP-1: $29.95. Assembler, Editor, Monitor (8080 mnemonics)
LST-1: 8.00. Listing of Level-1 BASIC with some comments

CP/M tm Digital Research, Inc. TRS-80 tm Tandy Corp.
See your dealer or order direct. Calif. Residents add 6% tax

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CIRCLE 184 ON READER SERVICE CARD

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2 disk drive program, written in assembly language and applesoft II completely menu-driven. Maintain all billing of clients and personnel. Generates Statements. Numerous reports based on all types of criteria. Easy data entry for rates, clients, and matters. Has search, sort, charge (On-screen editing), view and balance forward. If you are a job contractor, attorney, accountant, general consultant, or any one that needs to charge or account for time, this program is must. complete turnkey operation. Numerous reports are produced to aid in the time analysis process. Holds 120 employees & up to 300 client with a max of 1600 transactions per period. All this and much more.

Requires 48K and Applesoft II on ROM (or Apple II Plus). Accommodates serial1parallel 132 column printer. Error protection devices provided. Program diskette and instruction manual-$325.00 **MAILING LIST PROGRAM**-Print labels sorted or searched by 6 fields. On-screen editing. Line up routine. **$40.00**

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CIRCLE 253 ON READER SERVICE CARD

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☐ **BUDGET:** The heart of a comprehensive home finance system. Allows user to define up to 20 budget items. Actual expense input can be by keyboard or by automatic reading of CHECKBOOK II files. Costs are automatically sorted and compared with budget. BUDGET produces both monthly actual/budget/variance report and a year-to-date by month summary of actual costs. Color graphics display of expenses. . . $24.95

☐ **CHECKBOOK II:** This extensive program keeps complete records of each check/deposit. Unique check entry system allows user to set up common check purpose and recipient categories. Upon entry you select from this pre-defined menue to minimize keying in a lot of data. Unique names can also be stored for completeness. Rapid access to check files. Check register display scrolls for ease of review. 40 column printout. Up to 100 checks per month storage. Files accessible by BUDGET program $19.95

☐ **SAVINGS:** Allows user to keep track of deposits/withdrawals for up to 10 savings accounts. Complete records shown via screen or 40 column printer. $14.95

☐ **CREDIT CARD:** Keep control of your cards with this program. Organizes, stores and displays purchases, payments and service charges. Screen or 40 column printer display. Up to 10 separate cards $14.95

☐ UNIVERSAL COMPUTING MACHINE: $39.95 ⒶⓉ

A user programmable computing system structured around a 20 row x 20 column table. User defines row and column names and equations forming a unique computing machine. Table elements can be multiplied, divided, subtracted or added to any other element. User can define repeated functions common to a row or column greatly simplifying table setup. Hundreds of unique computing machines can be defined, used, stored and recalled, with or without old data, for later use. Excellent for sales forecasts, engineering design analysis, budgets, inventory lists, income statements, production planning, project cost estimates-in short for any planning, analysis or reporting problem that can be solved with a table. Unique curser commands allow you to move to any element, change its value and immediately see the effect on other table values. Entire table can be printed by machine pages (user-defined 3-5 columns) on a 40 column printer.

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HI-RES color graphics display of your personal calendar. Automatic multiple entry of repetitive events. Review at a glance important dates, appointments, anniversaries, birthdays, action dates, etc. over a 5 year period. Graphic calendar marks dates. Printer and screen display a summary report by month of your full text describing each day's action item or event. Ideal for anyone with a busy calendar.

☐ BUSINESS SOFTWARE: Entire Series $159.95 ⒶⓉ

☐ **MICROACCOUNTANT:** The ideal accounting system for the small business. Based on classic T-accounts and double-entry bookkeeping, this efficient program records and produces reports on account balances, general ledger journals, revenue and expenses. Screen or 40 column printer reports. Handles up to 1000 journal entries per month up to 300 accounts. Includes a short primer in Financial Accounting. . . $49.95

☐ **UNIVERSAL BUSINESS MACHINE:** This program is designed to SIMPLIFY and SAVE TIME for the serious businessman who must periodically Analyze, Plan and Estimate. The program was created using our Universal Computing Machine and it is programmed to provide the following planning and forecasting tools.

CASH FLOW ANALYSIS
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☐ **BUSINESS CHECK REGISTER AND BUDGET:** A combination of our CHECKBOOK II and BUDGET programs expanded to include up to 50 budgetable items and up to 500 checks per month. Includes bank statement reconciliation and automatic check search (48K). $49.95

☐ ELECTRONICS SERIES: Entire Series $159.95 Ⓐ

☐ **LOGIC SIMULATOR:** SAVE TIME AND MONEY. Simulate your digital logic circuits before you build them. CMOS, TTL, or whatever, if it's digital logic, this program can handle it. The program is an interactive, menu driven, full-fledged logic simulator capable of simulating the bit-time by bit-time response of a logic network to user-specified input patterns. It will handle up to 1000 gates, including NANDS, NORS, INverters, FLIP-FLOPS, SHIFT REGISTERS, COUNTERS and user-defined MACROS. Up to 40 user-defined, random, or binary input patterns. Simulation results displayed on CRT or printer. Accepts network descriptions from keyboard or from LOGIC DESIGNER for simulation. $89.95

☐ **LOGIC DESIGNER:** Interactive HI-RES Graphics program for designing digital logic systems. A menu driven series of keyboard commands allows you to draw directly on the screen up to 15 different gate types, including 10 gate shape patterns supplied with the program and 5 reserved for user specification. Standard patterns supplied are NAND, NOR, INVERTER, EX-OR, T-FLOP, JK-FLOP, D-FLOP, RS-FLOP, 4 Bit COUNTER and N-BIT SHIFT REGISTER. User interconnects gates just as you would normally draw using line graphics commands. Network descriptions for LOGIC SIMULATOR generated simultaneously with the CRT diagram being drawn. $89.95

☐ MATHEMATICS SERIES: Entire Series $49.95 Ⓐ

☐ **STATISTICAL ANALYSIS I:** This menu driven program performs SIMPLE LINEAR REGRESSION analysis, determines the mean, standard deviation and plots the frequency distribution of user-supplied data sets. Printer, Disk, I/O and edit routines included (32K min.) $19 95

☐ **NUMERICAL ANALYSIS:** HI-RES 2-Dimensional plot of any function. Automatic scaling. At your option, the program will plot the function, plot the INTEGRAL, plot the DERIVATIVE, determine the ROOTS, find the MAXIMA and MINIMA and list the INTEGRAL VALUE. $19.95

☐ **MATRIX:** A general purpose, menu driven program for determining the INVERSE and DETERMINANT of any matrix, as well as the SOLUTION to any set of SIMULTANEOUS LINEAR EQUATIONS. Disk I/O for data save. Specify 55 eqn. set (48K) or 35 eqn. (32K) $19.95

☐ **3-D SURFACE PLOTTER:** Explore the ELEGANCE and BEAUTY of MATHEMATICS by creating HI-RES PLOTS of 3-dimensional surfaces from any 3-variable equation. Disk save and recall routines for plots. Menu driven to vary surface parameters. Hidden line or transparent plotting $19.95

☐ ACTION ADVENTURE GAMES: Entire Series $29.95 Ⓐ

☐ **RED BARON:** Can you outfly the RED BARON? This fast action game simulates a machine-gun DOGFIGHT between your WORLD WAR I BI-PLANE and the baron's. You can LOOP, DIVE, BANK or CLIMB in any one of 8 directions - and so can the BARON. in HI-RES graphics $14.95

☐ **BATTLE OF MIDWAY:** You are in command of the U.S.S. HORNETS' DIVE-BOMBER squadron. Your targets are the Aircraft carriers, Akagi, Soryu and Kaga. You must fly your way through ZEROS and AA FIRE to make your DIVE-BOMB run. In HI-RES graphics $14.95

☐ **SUB ATTACK:** It's April, 1943. The enemy convoy is headed for the CORAL SEA. Your sub, the MORAY, has just sighted the CARRIERS and BATTLESHIPS. Easy pickings. But watch out for the DESTROYERS - they're fast and deadly. In HI-RES graphics $14.95

☐ **FREE CATALOG** - All programs are supplied on disk and run on Apple II w/Disk & Applesoft ROM Card & TRS-80 Level II and require 32K RAM unless otherwise noted. Detailed instructions included. Orders shipped within 3 days. Card users include card number. Add $1.50 postage and handling with each order. California residents add 6½% sales tax.

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CIRCLE 189 ON READER SERVICE CARD

WORD PROCESSING

Paper-Mate Command 60 for the PET is a word processor which incorporates full screen editing with graphics for all 16K and 32K PETs, all printers, and disk or tape drives using 60 commands. $29. A B Computers, 115 E. Stump Rd., Montogomeryville, PA 18936. (215) 699-5826.

CIRCLE 318 ON READER SERVICE CARD

Designed as an affordable yet powerful text editing addition to popular word processing software, **WordMaster Release 1.07** enhances existing file management facilities with searching, replacing, looping, conditional execution and matching capabilities,and provides compatibility with CRT "window" reviewing and "scratchpad" stored text editing functions. The CP/M compatible program sells for $150. MicroPro International Corporation, 1299 Fourth St., San Rafael, CA 94901. (415) 457-8990.

CIRCLE 319 ON READER SERVICE CARD

WordMagic is a word processor designed for the TRS-80 Model II. Its features include total TRS file Compatibility, cursor control, edit capability, paging, printing and automatic page number insertion. $100. CalData Systems, P.O. Box 178446, San Diego, CA 92117.

CIRCLE 320 ON READER SERVICE CARD

Electric Pencil II is now available for TRS-80 Model II users with CP/M. The Standard Print Package will run with serial or parallel interfaced printers. $275. The Diable/Qume Package will work with serial versions of these printers ($300), and the NEC Print Package will work with serial interface NECs only. $300. **Convert** is a conversion utility program which converts files created by Electric Pencil II into CP/M compatible files. $35. Michael Shrayer Software, Inc., 1198 Los Robles Dr., Palm Springs, CA 92262. (714) 323-1400.

CIRCLE 321 ON READER SERVICE CARD

EDUCATIONAL

The **Earth Science Series** for the TRS-80 includes 12 independent programs, each designed to teach a particular topic covered in junior or senior high school earth science courses. Also provided is **Lab Aid**, a program containing 20 of the most common formulas used in lab experiments. $59.95. **T.E.S.T**, also for the TRS-80, includes a Maintenance Program, which allows the user to create a test of up to 35 questions, and a Test and Drill Program, which is a utility designed to accept the test so created. $11.95. TYC Software, 40 Stuyvesant Manor, Geneseo, NY 14454.

CIRCLE 322 ON READER SERVICE CARD

CompuSoCo announces a school administration package for the Apple II and Apple II Plus. The system consists of four modules: The **Electric Gradebook**, which maintains assignment by assignment records of student progress ($49.95); the **Grade Program**, which allows the inputting of grades and test scores in order to prepare report cards ($259.95); the **Counsellor Element**, which is designed to aid in student scheduling ($89.95), and the **Schedule Component** which prepares master school class schedules and individual student schedules ($259.95). CompuSoCo, 26251 Via Roble, P.O. Box 2325, Mission Viejo, CA 92690.

CIRCLE 323 ON READER SERVICE CARD

Education Sampler for PET and TRS-80, provides test and drill practice in Algebra, Geometry and Chemistry. It includes user-selectable accuracy levels. $15. Harry H. Briley, Livermore, CA 94550.

CIRCLE 324 ON READER SERVICE CARD

CONDUIT, a non-profit organization which distributes computer-based **instructional materials**, has announced the availability of several units for Apple, TRS-80 and PET. Primarily simulations, the units address topics in biology, chemistry, physics, sociology and pyschology. Prices range from $30 to $100. CONDUIT, P.O. Box 388, Iowa City, IA 52244.

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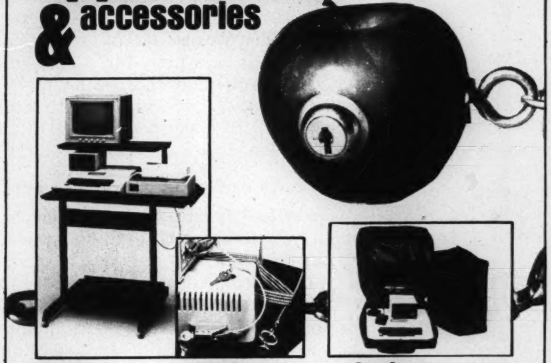
CIRCLE 255 ON READER SERVICE CARD

Apple Locker & accessories



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CIRCLE 261 ON READER SERVICE CARD

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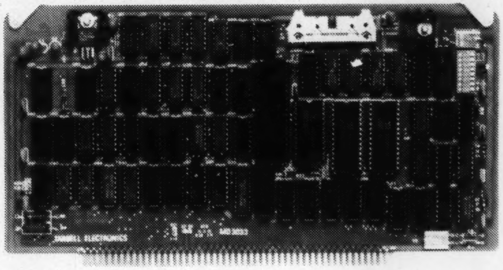

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CIRCLE 259 ON READER SERVICE CARD

Now tiny c Soars!

...with tiny-c two — the compiler

Tiny-c two is ten times faster than tiny-c one, with many features, including long (32 bit) integers, lots of new operators, and redirectable and direct access input/output. Viable for professional work, either systems programming or business applications.

It comes with a UNIX™ style command interpreter called the "tiny-shell"™. Every compiled tiny-c program becomes a new shell command. Commands can have arguments, and dash (-) options, just as real UNIX shell commands do. The < and > input/output redirection operators are supported.

Fifty standard library functions, and readily extended. The input/output functions are UNIX styles, including fopen, fprintf, etc. Both ascii and raw (binary) input/output are supported.

Package is portable. Bringing it up on a new processor or new operating system should take just days. And as usual with tiny-c products, all the source code is included.

Tiny-c two is available now on standard 8" CP/M.

$250.00 - Includes Owners Manual and Disk
Manual Only $50.00
(20% Discount to tiny-c one owners)

The original tiny-c ONE is still available on a wide varietv of cassettes and diskettes. This version is an interpreter, complete with a Program Preparation System. Disk or cassette versions $100 (this price includes the Owners Manual, available separateat $50). Disks: CP/M, Apple DOS 3.2, H8/89 HOS, PDP-11, Flex 2.0, Northstar, CDOS, Cassettes: KIM, SYM, TRS-80, Tarbell, Cuts.

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CIRCLE 268 ON READER SERVICE CARD

Compak, Inc., announces **Mathematics Package** for grades one through eight. The package, desinged for use on the 32K Apple and TI 99/4, covers addition, subtraction, multiplication, division, common fractions, decimal fractions, percents, measurements geometry and elementary algebr. Features include multiple skill levels, recordkeeping, color graphics, and sound. The complete package is $494, all concepts for a single grade level are $65, and one concept for all grade levels is $50. Compak, Inc., P.O. Box 14852, Austin, TX 78761. (512) 452-1680.

CIRCLE 326 ON READER SERVICE CARD

The **Class Scheduling System** for the Apple prepares all input forms, reports expected class conflicts and prepares final master school rosters and individual student schedules. The system, which will handle up to 2400 students at a time, requires 48K and two disk drives along with an 80-column printer. $249.95. Also available is **Light Pen Quiz** which allows teachers to create student quizzes which accept input from a light pen. The program requires Applesoft, 32K and one disk drive. $49.95. The **Counsellor's Program** allows for preparation of the school guidance counsellor's master student records and file folder records. $89.95. Charles Mann & Associates, Micro Software Division, 7594 San Remo Trail, Yucca Valley, CA 92284. (714) 365-9718.

CIRCLE 327 ON READER SERVICE CARD

Advanced Graphics Mini-Instruction Course, Volume 1, Curves is the first in a series of projects on graphics applications programming techniques for the 16K Level II or 4K Level I TRS-80. $19.95. Datagraphics. P.O. Box 566, Dept. G, Union Station. Endicott, NY 13760.

CIRCLE 328 ON READER SERVICE CARD

RECREATIONAL, GAMES

Monty Plays Monopoly and **Monty Plays Scrabble** are designed for use with game boards and equipment. The computer participates as one of the players. Monopoly is available for Apple and TRS-80 Level II on cassette for $24.95 and disk for $27.95. Scrabble is also available for CP/M systems at $29.95. Ritam Corporation, P.O. Box 921, Fairfield, IA 52556.

CIRCLE 329 ON READER SERVICE CARD

Squadron Leader games are historical simulations which place the player in command of a fighter squadron in one of six decisive campaigns of World War II. Games include, RAF: The Battle of Britain, MiGs and Messerschmidts, Jagdstaffel, Winged Samurai, Malta Strike, and Chennault's Flying Tigers, and are available for 16K TRS-80 Level II, Apple II, or PET. $19.95. Discovery Games, 936 W. Hwy. 36, St. Paul, MN 55113.

CIRCLE 330 ON READER SERVICE CARD

FS1 Flight Simulators for Apple and TRS-80 are visual flight simulators that offer a real-time 3D out-the-window view of flight. Animation and flight characteristics are said to allow the non-pilot to learn basic flight control and the experienced pilot to explore the flight characteristics of an aircraft. Available on cassette for $25, or Apple disk for $33.50. SubLogic Distribution Corp., Box V, Savoy, IL 61874. (217) 359-8482.

CIRCLE 331 ON READER SERVICE CARD

Sorcerer Asteroids is a machine language version of the arcade game. Other games available for Sorcerer include Action Bowling and Sub. Prices range from $9.95 to $19.95. Staley's Sorcerer Software, 3497 School Rd., Murryville, PA 15668.

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CIRCLE 124 ON READER SERVICE CARD

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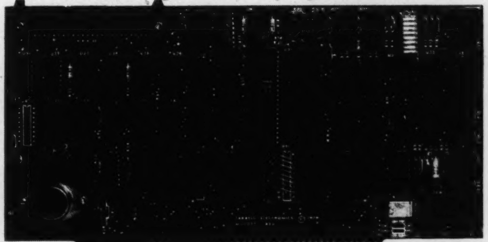

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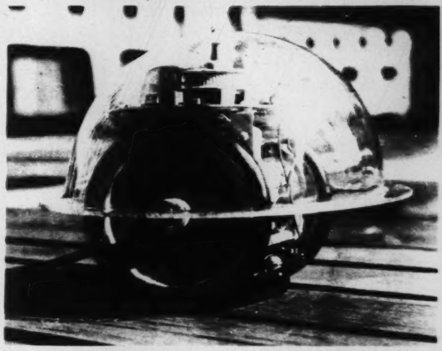

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EDUCATORS...
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CIRCLE 235 ON READER SERVICE CARD

Computer Napoleonics: The battle of Waterloo is a division scale game that recreates Napoleon's last battle against the Duke of Wellington. $59.95. **Computer Quarterback** is a real-time strategy football game. $39.95. Both games are available on disk for the Apple with 48K memory and Applesoft, and allow the user to play against the computer or a human opponent. Strategic Simulations, Inc., 450 San Antonio Rd., Suite 62, Palo Alto, CA 94306.

CIRCLE 334 ON READER SERVICE CARD

Sunmax for 16K TRS-80 Level II computers gives each of from one to nine players a solar energy job such as home heating, hot water heating or home air conditioning in one of 200 cities around the world. The player must guess the tilt of the solar collector which will maximize the amount of solar energy collected. $8. Solartek, P.O. Box 298, Guilderland, NY 12084.

CIRCLE 335 ON READER SERVICE CARD

Pigskin, a football strategy game for the TRS-80 Level II, features a graphic display of the field and shows ball movement and statistics. Cassette, $9.95; disk, $15.95. Acorn Software, Inc., 634 North Carolina Ave., S.E., Washington, D.C. 20003. (202) 544-4259.

CIRCLE 336 ON READER SERVICE CARD

Small Business Systems Group announces a **games package** for the TRS-80 Model II. The Mean Checkers Machine is executed from DOS, while the other six—Star Trek, Dog Star Adventure, Treasure Hunt, Concentration and Banko—are written in Basic. $75. Small Business Systems Group, Inc., 6 Carlisle Rd., Westford, MA 01886. (617) 692-3800.

CIRCLE 337 ON READER SERVICE CARD

Morton's Fork, the third in the Maces & Magic series of adventure programs for TRS-80, CP/M and Micropolis disk systems, features a multi-level role playing, simulation set in an ancient wizard's fortress. $35. Chameleon Software, Inc., 4733 North Mitchner, Indianapolis, IN 46226. (317) 545-5098.

CIRCLE 338 ON READER SERVICE CARD

BOOKS AND BOOKLETS

SOFTWARE VENDOR DIRECTORY

The **Software Vendor Directory**, a listing of microcomputer software vendors, is now available from Micro-Serve, Inc.

The publication lists over 700 vendors within 35 categories of hardware and operating systems. Software is classified into: personal, programming, general business, and industry. Vendors of books and other publications have also been included. $37.95.

Micro-Serve, Inc., P.O. Box 482, Nyack, NY 10960.

CIRCLE 339 ON READER SERVICE CARD

HANDBOOK ON FUNDING FOR EDUCATORS

A handbook developed to assist educational institutions in identifying sources of financial support--enabling acquisition and use of microcomputer technology for instruction--has been published by Bell & Howell's Audio-Visual Products Division.

Titled "Funding Report for Microcomputers," the 44-page publication is the result of contact with officials of eight federal agencies and the departments of education.

Bell & Howell Audio-Visual Products Division, 7100 N. McCormick Rd., Chlicago, IL 60645.

CIRCLE 340 ON READER SERVICE CARD

COMPUTER-ORIENTED BIBLIOGRAPHY

More than 250 new computer books were published last year. All are listed in the 13th Edition of the **Annual Bibliography of Computer-Oriented Books**, released by the University of Colorado.

There was a decline in the number of new books in the application areas (only 20), and an increase in books on microcomputers and personal computing (14).

The bibliography contains more than 1,000 books from over 150 publishers. It

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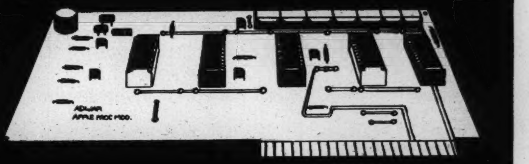

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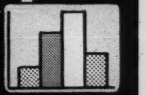

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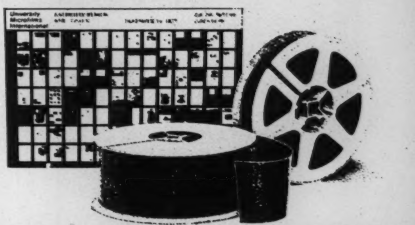

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MAGAZINES, NEWSLETTERS

REVIEWS OF APPLE SOFTWARE

Peelings is a publication devoted exclusively to reviews of software for the Apple II and Apple II Plus microcomputers.

Each bi-monthly issue will contain in-depth reviews of twelve to fifteen programs or software packages. Subscriptions are $15.

Peelings, c/o Ed Burlbaw, 945 Brook Cir., Las Cruces, NM 88001. (505) 523-5088.

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PASCAL NEWSLETTER

Rational Data Systems announces a free **Pascal Newsletter.**

It includes articles dealing with subjects of general interest such as Pascal standards and programming techniques. Recent newsletter articles have included a history of Pascal compilers, a Pascal bibliography, a comparison of RDS Pascal to competitive products and the "Programmer's Page" which deals with matters of programming style.

Rational Data Systems, 245 West 55th St., New York, NY 10019. (212) 757-0011.

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MISCELLANEOUS

LAZY SUSAN FOR CRT

A swivel device that applies the "lazy susan" principle to the CRT terminal, increasing operator efficiency and potentially saving the cost of extra terminals, is available from Inmac.

The Turn 'n Key swivel device allows full 180° rotation of a CRT terminal, enabling two or more operators to use the same terminal.

Turn 'n Key comes in two sizes, each able to hold up to 200 pounds. The 16"-square size is priced at $55, and the 20"-square size at $62.

Inmac, 2465 Augustine Dr., Santa Clara, CA 95051.

CIRCLE 344 ON READER SERVICE CARD

PASCAL REFERENCE CARD AND AUTO DIALER

The Pascal Reference Card is a compressed assemblage of almost everything needed to program in Pascal. On one folded 8½ x 11" card, all the following data are available: ASCII chart, Procedure and Function definitions, Reserved and Predefined words, I/O Error return, Setup Parameters, P-code chart, and Operators with Precedence, $2.

The Autodialer II allows Apple II users to dial ABBS, CBBS, and Forum 80. It features a multi-page menu and single key select. Autodialer II requires Applesoft II and Micromodem, $15.

Modular Software, POB 12883, San Antonio, TX 78212.

CIRCLE 345 ON READER SERVICE CARD

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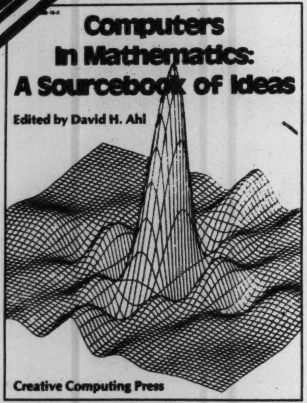

Computers in Mathematics: A Sourcebook of Ideas

Edited by David H. Ahl

Creative Computing Press

Computers in Mathematics: A Sourcebook of Ideas

Here is a huge sourcebook of ideas for using computers in mathematics instruction. There are sections on:

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One section presents over 250 problems, puzzles and programming ideas, more than are found in most "problem collection" books.

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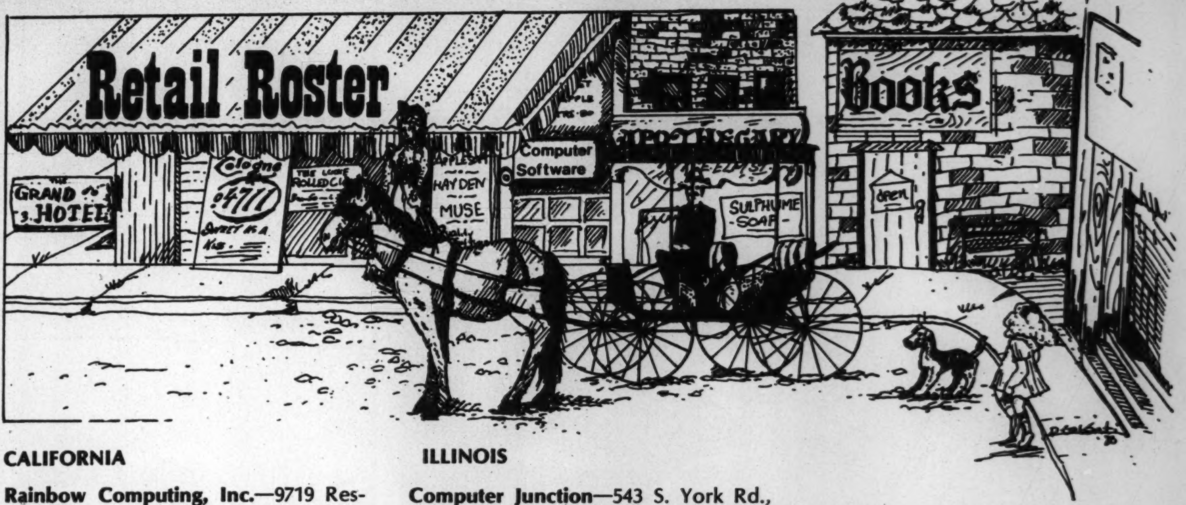
The book includes many activities that don't require a computer. And if you're considering expanding your computer facilities you'll find a section on how to select a computer complete with an invaluable microcomputer comparison chart.

Although much of the material has appeared in Creative Computing, many of those back issues are no longer available. Consequently this book meets the demand of making available that popular information.

Edited by David Ahl. Large format paperbound, 224 pages, $15.95. (12D)

To order use handy postcard order form inside back cover.



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D.E.S. Data Equipment Supply—8315 Firestone, Downey 90241. (213) 923-9361. 7 days. Commodore PET specialists. Hardware Software, Books, Mags, Supplies, In House Maintenance.

Advance Data Concepts—2280 Diamond Blvd., Concord, 94520; (415) 671-9016. 9-5 Mon-Fri. Vector-Graphic, CP/M Software Headquarters-User's Group.

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Computerworks—1439 Post Rd., East Westport 06880; (203) 255-9096. 12-6 Tues-Fri, 12-9 Thu, 10-5 Sat.

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Atlanta Computer Mart—5091 Buford Hwy, Atlanta 30340; (404) 455-0647. 10-6 Mon-Sat.

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Computer Junction—543 S. York Rd., Elmhurst 60126; (312) 530-1125. Mon & Thu 9:30-8:30 pm; Tues-Sat 9:30-5:30; Sun 12-4:30.

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OUTPUT

Claire Stuart

Gamma Six
Altron Calculator Co. Third Annual Research and Marketing Workshop

Zatok beamed at his staff. "The new model student's calculator is just what we need to push us ahead of the competition. i'm putting the specifications into the computer bank now, and they'll be at the disposal of everyone in sales and marketing. You may begin work on the advertising campaigns immediately."

His digits raced over the keys. INSERT ORDER, DATA BANK, DISC 100110, STORAGE TYPE-BSU LOCATION 111101, CALL CODE 001101/ABX.

West Hill Community Hospital

Brian Manning fumbled open his third pack of cigarettes just as the nurse bounced into the room. "It's a fine baby girl, Mr. Manning!"

In the delivery room, Laura Manning smiled weakly as the doctor held up her newborn daughter. "Christine," she whispered. "We're calling her Christine."

April 2
Breckenridge State College

Chris Manning nibbled thoughtfully on the end of her pencil as Dr. Bailey covered the blackboard with angular scrawls.

"As you see, the computer's hardware is under the control of the software— that's the program. The program tells it what to do, and that is what the computer does. No more and no less. That's why it is so essential that a good program be complete and unambiguous."

Chris broke in. "But the computer can make decisions, can't it?"

"Of course, but only based on the information it has been given. For example, if you give the computer a series of numbers in pairs and ask it to indicate the larger number in each pair, you must first define 'larger' or the computer cannot execute the instructions."

"Do you think that someday we'll be able to build a computer that really thinks? I mean, with consciousness?"

Dr. Bailey sighed and rolled his eyes. "Ms. Manning, we build a computer to perform certain operations and we define the problem we wish solved. We give it input. It generates output based on that input. It is simply a machine. Now even you wouldn't ask if we expect a programmable microwave oven to develop consciousness, would you, Ms. Manning?"

Chris reddened and slid down in her seat, wishing she could make herself invisible. She stared at the clock, and as soon as the minute hand reached the hour, she grabbed her books and bolted for the door.

Chris started for her next class at a brisk walk. As she passed the campus computer center, she impulsively stopped in the doorway. Students were busy at all the keypunch machines and the air seemed to vibrate with the hums of the instruments and the whirrs and slaps of the card sorters. Chris watched and listened a few moments, glanced at the clock and realized she was late for psych class, then hurried on her way.She slipped quitely through the rear door of the classroom and into a seat beside her boyfriend, Alex.

Dr. Bronstein was clearing his throat and tapping his pointer on a large plastic model of a human brain. "With all we know about the brain, there is much more

---

Claire Stuart, 937-B West Main, Bridgeport, W VA 26330.

AIR TRAFFIC CONTROLLER

In **Air Traffic Controller** you assume responsibility for the safe flow of air traffic within a 15x25 mile area up to 5,000 feet in altitude. During your shift as a controller in charge of this airspace, 26 aircraft become active and under your control. Jets and prop planes have to be guided to and from the two airports, navigational beacons and ten entry/exit fixes. The aircraft enter the controller's airspace at various altitudes and headings whether or not you are ready.

Air Traffic Controller retains the basic realism of air traffic control. This program requires the same steady nerves under pressure and the same instant, almost instinctive, analyses of complex emergencies which are demanded of a professional air traffic controller. But "ATC" adds the excitement and well-defined goals of a game. This is just a simulation, and all passengers left in air traffic limbo by a panicked player will live to fly another day.

Your goal is to get all of the aircraft to their assigned destination before the shift is completed. At your disposal are a radar display of the aircraft positions in the control area; coded information concerning aircraft heading, destination and fuel supply; navaids enabling you to hold aircraft or assign them automatic approaches; and commands to alter the altitude and heading of the aircraft. Working against you are altitude and heading requirements, fuel restrictions and, of course, the inimitable clock.

The most obvious measure of difficulty of a game is the clock setting at the beginning. In a 99 minute game you will have time to go fix a sandwich between the appearance of two successive aircraft, while in the 16 minute game you may not have time to swallow before all of the aircraft have appeared.

No two games, even at the same clock setting, are ever alike. As controller, you must cope with the unique requirements of each aircraft. The game will end if you commit a "boundry error," that is, if an aircraft fails to leave your area at the proper altitude and exit fix...causing an unpleasant surprise for the controller next door. The game also ends if you fail to leave a comfortable margin of safety between the aircraft as they whiz past each other. In cases of excessive delay, fuel supply considerations will become invested with a particular sense of urgency.

Successful guidance of all aircraft to their destination is a heady accomplishment. This never fails to thrill ATC enthusiasts at each successive level of play.

Your local retail store should carry Creative Computing Software. If your favorite retailer does not carry the software you need, have him call in your order to (800) 631-8112. Or you can order directly from Creative Computing. Write to Creative Computing Software, P.O. Box 789-M, Morristown, NJ 07960. **Air Traffic Controller** is now available for the 16K TRS-80 (3006), for the 16K Apple II and Apple II Plus (4008), the 8K Sorcerer (5008) and for the 4K Sol-20 (8001). All are on cassette for $9.95. Include $1.00 for postage and handling. For faster service, call in your bank card order toll free on our order hotline, (800) 631-8112.

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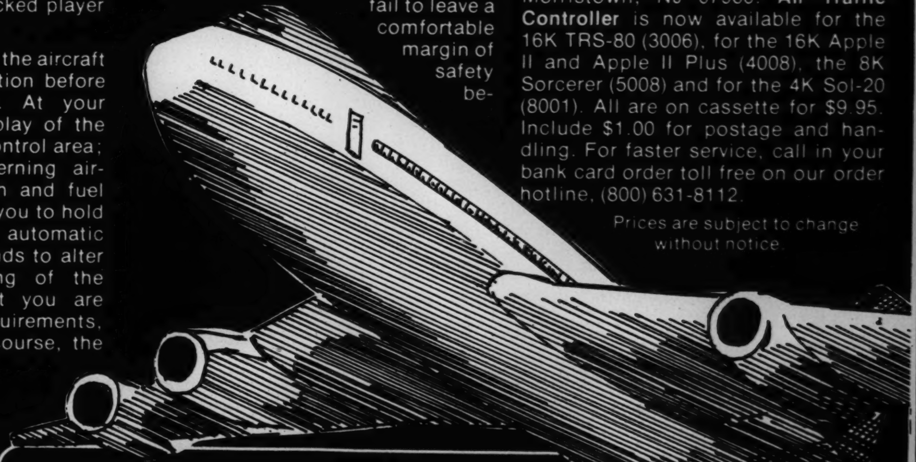


creative computing software

sensational software

CIRCLE 300 ON READER SERVICE CARD

OUTPUT, cont'd...

we DON'T know. For example, no one really understands the phenomena we call consciousness. Last time we met, a student asked,'Where is my consciousness when I am asleep?' "

The class snickered, but Bronstein scowled and went on. "You laugh! But think about it! It is a valid question. So! Where are you when you are asleep? We do not know! We have found no 'place' where consciousness can 'go.' It IS and then it IS NOT. Perhaps we may consider consciousness as only occurring when certain electro-chemical processes are going on. When they are not occurring, there is no consciousness. But the POTENTIAL for consciousness still exists at the sites of the reactions."

"Dr. Bronstein," interrupted Chris, "do you mean that when these reactions aren't going on, I don't exist, and that I'm 'reborn' so to speak, every time they begin again?"

"You could put it that way. But let's not lose sight of the fact that we're only guessing about things we do not yet understand. To continue, let's consider the brain as an electrical billboard like those used at ball games. The board is covered with light bulbs which have the potential for spelling out messages. When certain circuits are engaged, certain bulbs light up and a message appears. When the bulb goes out, is the message gone?Yes and no. It is no longer visible, but it is still POTENTIALLY there and can reappear when certain bulbs go on again. Perhaps consciousness is similarly generated."

Chris frowned. "Since the message is maybe what you'd call a by-product of certain circuits hooking up, maybe our consciousness is only a by-product of something else our brains are doing."

"Ms. Manning, I think we're digressing into things more appropiately discussed in a philosophy class, don't you? Let's move onto something we can examine in the lab. Now if I may have everyone's close attention, you'll notice that this cage contains a rat with an electrode implanted in it's brain..."

Alex grinned at Chris and whispered, "You're really into some heavy thoughts."

"Well, don't you ever wonder about things like that? Like what we are and what life is for?"

"What I wonder about is if I'll call you someday and your roommate will tell me you went to Tibet to contemplate your navel or something!"

Gamma Six
Altron Calculator Co. Computer Seminar for New Employees

Zatok rapped on the table with his brensch. "Today we'll see the operation of our data storage and retrieval systems, tremendously efficient systems, by the way. The basic storage storage unit is the Biological Storage Unit, or the BSU. BSU's vary tremendously in size and complexity, but regardless of size, all are self replicating. The self-replicating system is the greatest work-saver in modern history! And it was developed right here, at Altron! Each unit is initially programmed to replicate the data it carries as many times as the information will be required, and to replicate the data WHEN it is required. A very simple BSU carries data that will only be needed a few times. A large BSU may carry billions of data replications if many departments will need the information simultaneously. In that way, there is no time delay while one department waits for information being used by another. And there is no wasted material. Old BSU's may be destroyed, although most are programmed to self-distruct at a given time. In any event, the components of the BSU's are always recycled in the building of new units.

April 3
Breckenridge State College

Dr. Alonzo switched off the projector. "You've seen the double-helical structure of DNA, and we've discussed how the 'unzipping' of the helix allows replication, as well as how messenger and transfer RNA work in building proteins. Remember, the group of three nucleotides constitutes a 'codon,' the basic unit of information in the genetic code. GUU is the codon for the amino acid valine, CCA for proline, and so on, with these amino acids being joined to make a protein. UAA, UAG and UGA are codons which mean 'stop' and which lead to the termination of the protein chain."

Chris poked Alex. "It's just like a computer, isn't it!"

Dr. Alonzo raised her eyebrow, then continued. "In the nucleus of each cell is a complete 'blueprint' for building a new individual, whether a human being or a one-celled organism. Included are timed instructions for starting and stopping the manufacture of tissue and organ systems. It may say, 'Differentiate into lung tissue' at a given time, then 'Stop building lung tissue.' "

Chris' hand shot up. "What about consciousness? Is there a message in the genes that tells when consciousness begins?"

"If someone could answer that question, it would certainly help in dealing with the abortion issue, wouldn't it," replied Dr. Alonzo dryly.

April 3
Alex Brandon's apartment

Chris wriggled out of Alex's arms and propped herself up on one elbow. Then she flickered.

Gamma Six
Altron Calculator Co. Computer Seminar for New Employees

Zatok assembled the group around the console. "Nemk has punched the code for retrieval of a BSU. You can see the retrieval order in the screen. The data bank has been searching for Disc100110, BSU 001101/ABX from location 111101. AH, it has arrived. Now we shall read it."

The reader whirled faster than eyes could follow, and data flashed on the screen. "....GUUAUCUUC-ACAAU......UAG."

"Now we feed this output into our translator (developed here at Altron, by the way). Fine! As you can see, this BSU contains specifications for a student's calculator. Incidentally, this calculator design really needs to be revamped."

April 3
Alex Brandon's apartment

Alex's face was white. "My God, Chris, I must be going nuts! I could have sworn you disappeared for a second and then reappeared!"

"Disappeared! What were you smoking before I got here?" Chris started to laugh, then fell silent when she saw the expression on Alex's face. "Hey! You're serious, aren't you? Do you feel okay? Do you want to go over to the Student Health Center?"

"Chris, really, it looked like you sort of FLICKERED! Oh, never mind, forget it! My eyes must be playing tricks on me. Too much reading or something."

Gamma Six
Altron Calculator Co. Fourth Annual Research and Marketing Workshop

Zatok pointed to the calculator displayed on the screen. "You are all aware of the fact that this calculator is out-dated, and the competition is moving ahead. Now with just a few modifications, we can get back in the lead. With a minimum of work, we can combine our current student's calculator with some of Model J-5's circuitry. The result will be a teriffic new machine with the same compact size and some great new selling features. It will appeal not only to students but to technicians, merchants, just about everyone. Bolf is feeding in the specifications of both existing calculators, and the computer will put them together and give us a mockup of the proposed new unit."

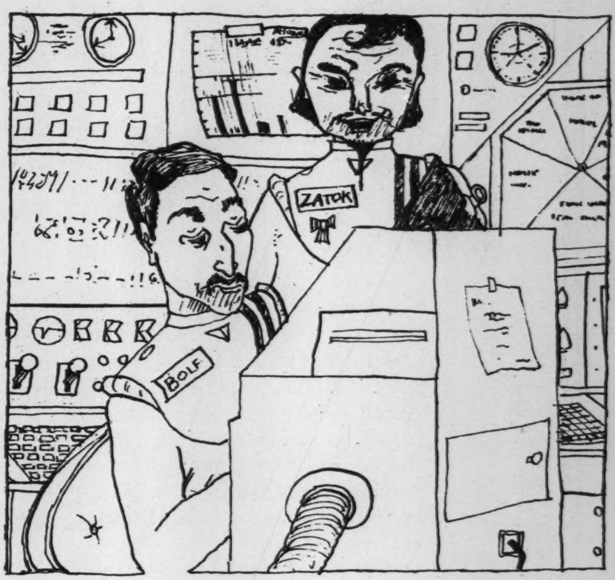
Bolf gathered the printouts that spewed from the computer. "Here we are! Designs for our new calculator!"

June 10
Alex Brandon's apartment

Chris stared moodily out the window, ignoring the nervous drumming of Alex's fingers on the table. Finally Alex hit the table with his fist.

"I can't stand any more of this! Chris, what's eating you? You've been acting weird for weeks."

"I guess there's no easy way to say it. I'm pregnant." □



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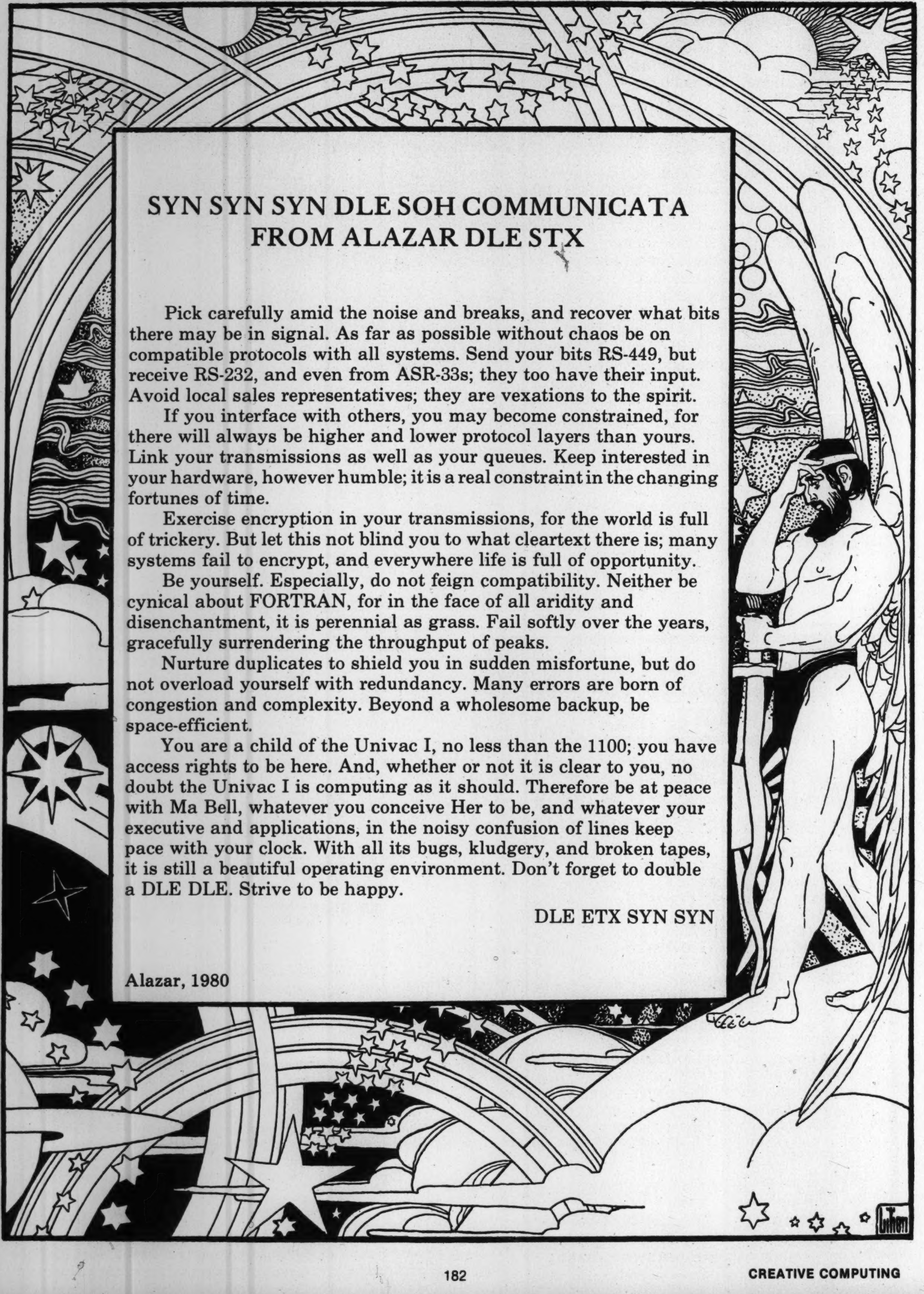


SYN SYN SYN DLE SOH COMMUNICATA FROM ALAZAR DLE STX

Pick carefully amid the noise and breaks, and recover what bits there may be in signal. As far as possible without chaos be on compatible protocols with all systems. Send your bits RS-449, but receive RS-232, and even from ASR-33s; they too have their input. Avoid local sales representatives; they are vexations to the spirit.

If you interface with others, you may become constrained, for there will always be higher and lower protocol layers than yours. Link your transmissions as well as your queues. Keep interested in your hardware, however humble; it is a real constraint in the changing fortunes of time.

Exercise encryption in your transmissions, for the world is full of trickery. But let this not blind you to what cleartext there is; many systems fail to encrypt, and everywhere life is full of opportunity.

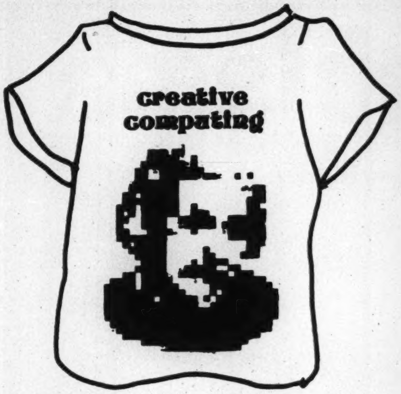
Be yourself. Especially, do not feign compatibility. Neither be cynical about FORTRAN, for in the face of all aridity and disenchantment, it is perennial as grass. Fail softly over the years, gracefully surrendering the throughput of peaks.

Nurture duplicates to shield you in sudden misfortune, but do not overload yourself with redundancy. Many errors are born of congestion and complexity. Beyond a wholesome backup, be space-efficient.

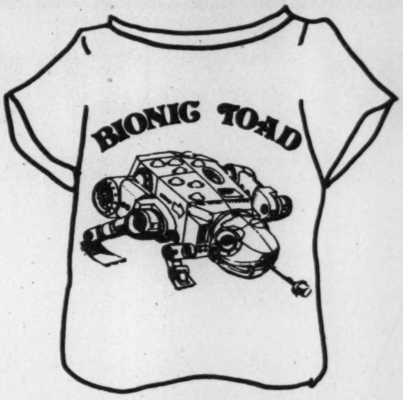
You are a child of the Univac I, no less than the 1100; you have access rights to be here. And, whether or not it is clear to you, no doubt the Univac I is computing as it should. Therefore be at peace with Ma Bell, whatever you conceive Her to be, and whatever your executive and applications, in the noisy confusion of lines keep pace with your clock. With all its bugs, kludgery, and broken tapes, it is still a beautiful operating environment. Don't forget to double a DLE DLE. Strive to be happy.

DLE ETX SYN SYN

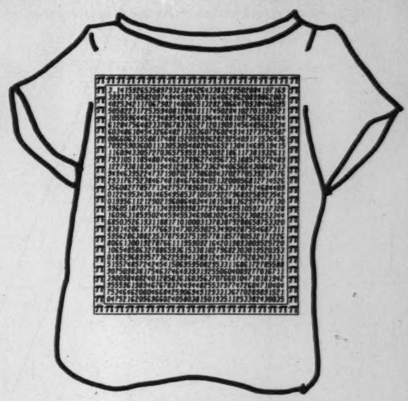
Alazar, 1980


creative
computing

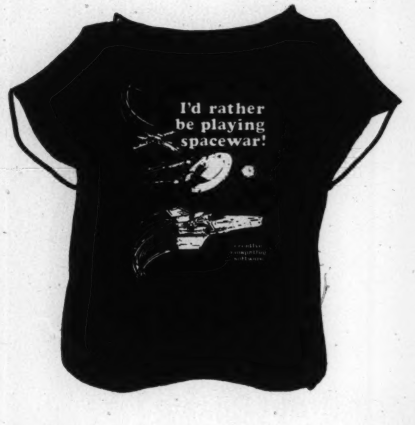
Creative Computing-- Albert Einstein in black on a red denim-look shirt with red neckband and cuffs.


BIONIC TOAD

Creative's own outrageous **Bionic Toad** in dark blue on a light blue shirt for kids and adults.



Plotter display of **Pi to 1362 Places** in dark brown on a tan shirt.


I'd rather
be playing
spacewar!

I'd rather be playing spacewar-- black with white spaceships and lettering.

Give your tie a rest!

All T-shirts are available in adult sizes S,M,L,XL. Bionic Toad, Program Bug and Spacewar also available in children's sizes S (6-8), M (10-12) and L (14-16). Made in USA. $6.00 each postpaid.

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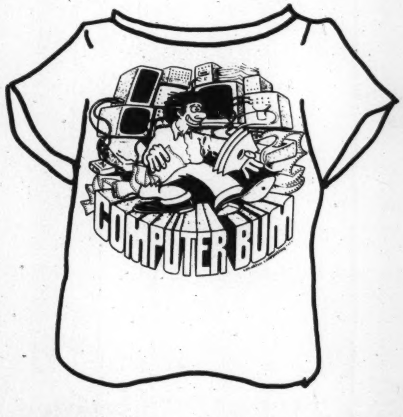
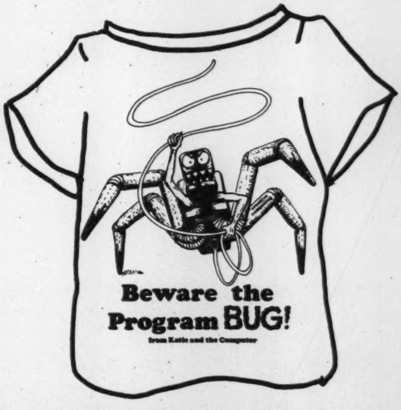
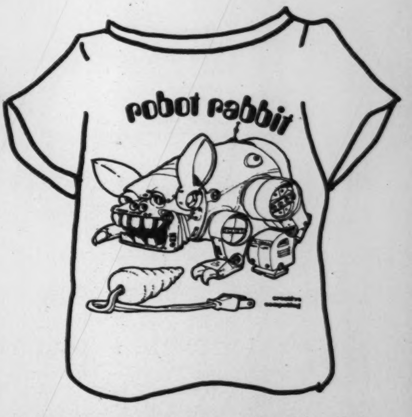

COMPUTER BUM

Computer Bum-- black design by cartoonist Monte Wolverton on gray denim-look skirt with black neckband and cuffs.

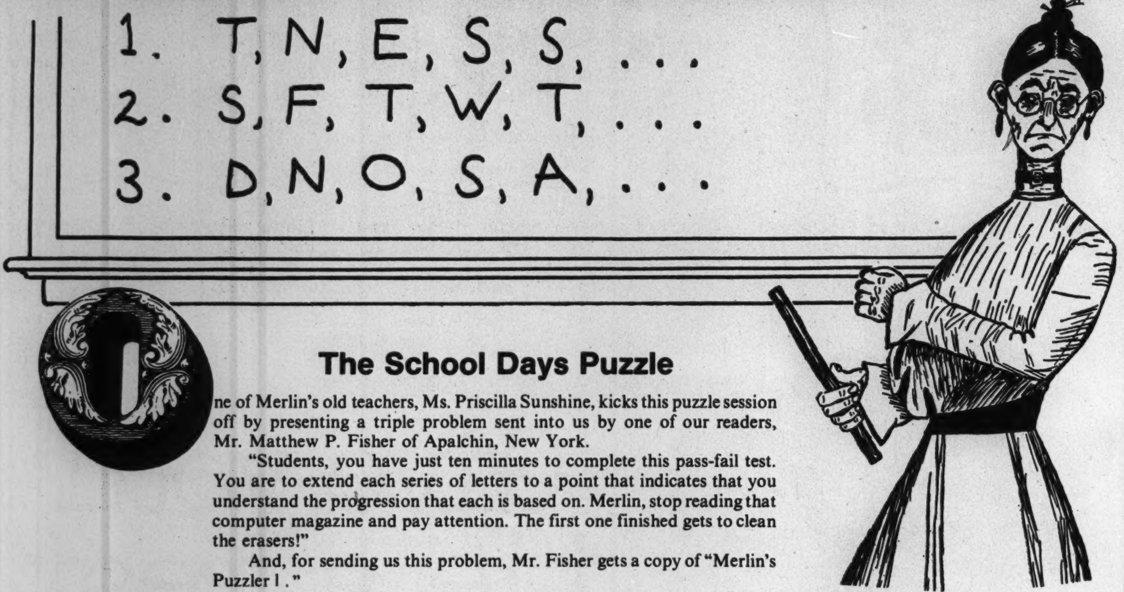

Beware the
Program BUG!
from Katie and the Computer

The **Program Bug** that terrorized Cybernia in Katie and the Computer is back on this beige t-shirt with purple design. You can share the little monster with your favorite kid.


robot rabbit

Roll down the block with this little black **Robot Rabbit** (on a bright orange t-shirt) on your back and you can intimidate every carrot, radish or cuke in your way.

puzzles & problems



1. T, N, E, S, S, . . .
2. S, F, T, W, T, . . .
3. D, N, O, S, A, . . .

The School Days Puzzle

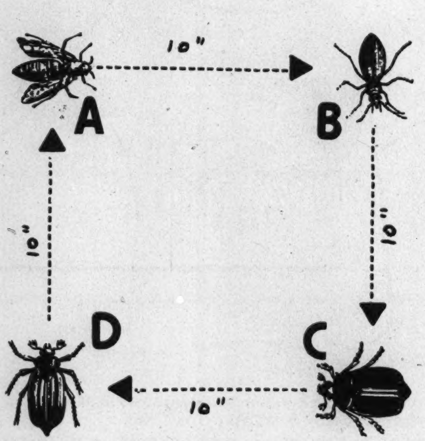
One of Merlin's old teachers, Ms. Priscilla Sunshine, kicks this puzzle session off by presenting a triple problem sent into us by one of our readers, Mr. Matthew P. Fisher of Apalchin, New York.

"Students, you have just ten minutes to complete this pass-fail test. You are to extend each series of letters to a point that indicates that you understand the progression that each is based on. Merlin, stop reading that computer magazine and pay attention. The first one finished gets to clean the erasers!"

And, for sending us this problem, Mr. Fisher gets a copy of "Merlin's Puzzler I."

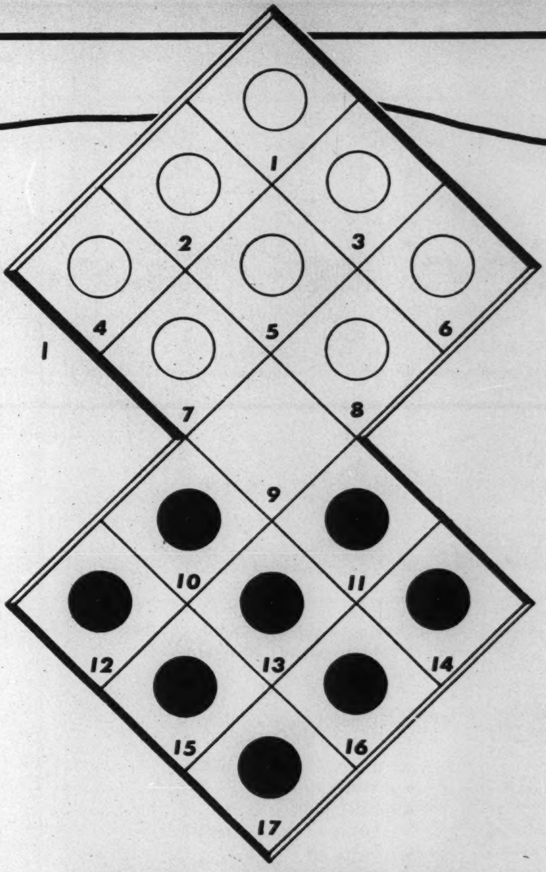
The Rich Broth Puzzle

Now, in the figure at the left we have an interesting puzzle. The soup tureen pictured here is not valued at $700, but rather it contains $700. The money is all in silver and it is divided into quarters, half-dollars, and dollars, there being an equal number of each. How many of each are there? (This puzzle is from "Merlin's Puzzler 2").



A Repellent Problem

Four bugs were positioned on top of a table as shown in the picture. Each bug was exactly ten inches away from the bug that it was facing. If each bug starts crawling simultaneously, and at a constant speed, towards the bug that it is facing, that is, *A* towards *B*, *B* towards *C*, *C* towards *D*, and *D* towards *A*), what distance will each bug have traveled when they all meet?



The Fore And Aft Puzzle

Above is a puzzle board for an old problem by America's greatest puzzle inventor, Sam Loyd, called "The Fore And Aft Puzzle." The playing board is made up of seventeen squares on which are placed eight white counters and eight black counters. (The illustration shows how the counters are positioned at the beginning of play.) This is a transpositional type of puzzle where you must make the white and black counters change positions in the fewest possible moves. A counter can be moved from one square to an adjacent vacant square. It may also jump over an adjacent counter of either color to an empty square beyond. All moves must be either horizontal or vertical, no diagonal moves please! (This puzzle is from "Merlin's Puzzler 3").

The Bell and the Durango Kid

Reverend I.N. Spire has purchased a new bell for his church, and somehow, he was able to talk the Durango Kid into helping him hang it. The interesting thing is that the bell and the Kid weigh exactly the same. When the Kid started hauling on the rope a surprising thing happened. See if you can guess.

(1) Did the bell go up while the Kid stayed down?
(2) Did the Kid go up while the bell stayed down?
(3) Did the Kid and the bell go up together?
(This puzzle is from "Merlin's Puzzler 3").

Answers on page 224

If you would like a free copy of one of Merlin's puzzle books, send along your favorite puzzle, and, if Merlin uses it, he will send you one of his books.

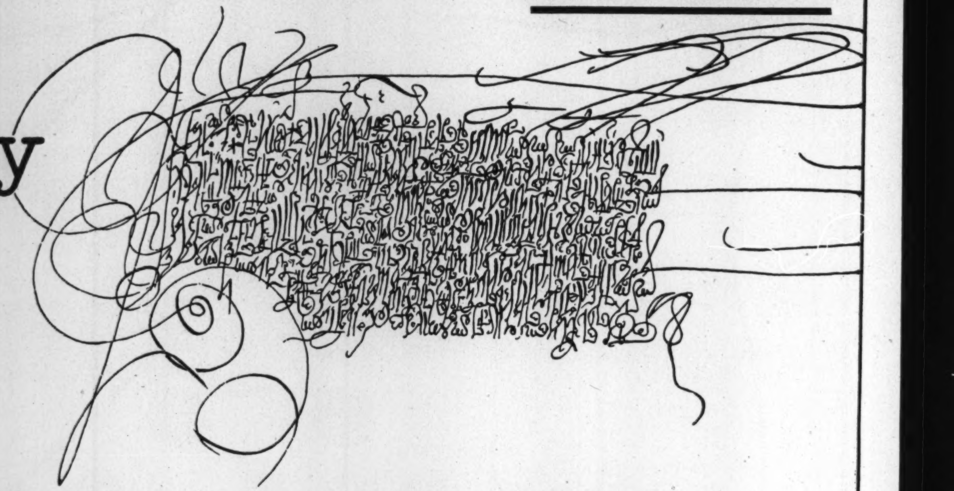
See you all again next month.

Your editor,

Charles Barry Townsend

Edmond H. Weiss, Ph.D.

Too Many Words



Edmond H. Weiss teaches effective writing seminars for business, industry, and government. To contact him, call 609-795-5580.

Most first drafts are too long. The sections are too long; the paragraphs are too long; the sentences are too long. Many people mistakenly believe that this excess length comes from trying to say too much, trying to give too much information or too many details. Actually, most of the reports and memos I read do *not* have too much information; what they have is *too many words.*

First drafts are almost always wordy and long-winded — and for a good reason. By using several words where one will do, writers have more time to think. Writing *should it prove to be the case that* in place of *if* gives your mind an eight-word stretch in which to plan the important parts of the sentence.

Wordiness, then, is a natural condition of first drafts. And the only way to cure your writing of the condition is to edit and revise your first drafts until they are free of wind and fog.

DO NOT TRY TO WRITE A CONCISE FIRST DRAFT. It takes less time to write a clumsy first draft and polish it later than to try to write a first draft that is stylistically correct. Rather, to save time and do a better job, inspect your first drafts for the following bugs.

Phobias

Many writers seem neurotically frightened of small function words like *about, then, if, with,* and others. (I suppose the neurosis has something to do with being told to write "five hundred word themes" in college; empty-headed sentences could get you a C if they were wordy enough.)

For example —

Instead of *about,* people will write:
- with regards to
- on the subject of
- relating to the matter of
- relative to

Instead of *then,* people will write:
- at that time
- at that point in time
- during that earlier period of time
- in that prior time frame

Instead of *if,* people will write:
- in the event that
- should it turn out that
- with regard to the possibility that
- should it prove to be the case that

Instead of *with,* people will write:
- by means of
- by utilizing
- through the employment of
- with the utilization of

Redundancy

Look out for phrases that say the same thing twice. You do not need to write *man-day of effort;* a man-day is a unit of effort. (*Man-day of effort* is as bad as *gram of mass* or *a square foot of area.*) Do not write *consensus of opinion;* that's the only kind of consensus there is. Here are a few others to avoid:

REDUNDANT	BETTER
period of time	period
interval of time	interval
present status	status
past history	history
concatenated together	concatenated

Excess Qualification

Do not modify or qualify terms that do not need to be modified or qualified. *Entirely complete* usually means the same thing as *complete.*

TOO MUCH	BETTER
complete stop	stop
totally dedicated	dedicated
active consideration	consideration
utterly unique	unique
perfectly compatible	compatible

These extra modifiers do not really add any emphasis or impact. *We reject the proposal* is stronger than *We completely reject the proposal;* and calling something *clear* is much more emphatic than calling it *perfectly clear.*

Phrases

Phrases, then, can be turned into single words. *As of this time* can become *now; extremely radical* can become *radical.* There are many other ways to trim phrases into single words — or even into tiny suffixes. Consider these pairs of sentences:

Before: *It is obvious* that they were looking for a manager *with more experience.*
After: *Obviously,* they were looking for a *more experienced* manager.

Before: *As is becoming apparent,* they will not accept the test report until it is *without a flaw.*
After: *Apparently,* they will not accept the test report until it is *flawless.*

Among the phrases that are best turned into single words are the "smothered verbs" (see my column in the August issue). Most first drafts are filled with opportunities to convert *conduct a meeting* to *meet;* or *achieve a resolution* to *resolve;* or *undertake an investigation* to *investigate.*

Edmond H. Weiss, Ph.D., 1612 Crown Point Lane, Cherry Hill, NJ 08003.

Clauses

In many sentences, even whole clauses can be trimmed to a short phrase or, sometimes, a single word. Consider this pair:

Before: *Once the meeting had been completed,* the senior programmer went to work on the improvements *that were demanded by the customer.*
After: *The meeting over,* the senior programmer went to work on the improvements *demanded by the customer.*

Fog

As many of you know, the most popular technique for assessing how difficult a text is to read (its "readability") is Robert Gunning's famous Fog Index. Gunning's measure — like those of several others — treats words-per-sentence as one of the two main predictors of difficulty. (Word length is usually the other.) Obviously, the phrase trimming techniques described above will shorten your sentences and improve your "readability" scores — and without any loss of information or precision. Consider this pair:

Before: The general feeling of the meeting was that within the framework of the tests a great deal has been accomplished and learned by all parties, and the prototype system had achieved most of the objectives with regard to showing the functional capabilities of SHIP in an INFO/TSO environment.
After: At the meeting everyone agreed that the tests were successful, having proved that SHIP works efficiently in an INFO/TSO environment.

Although you really should not use the Fog Index with a single sentence, it is still interesting to point out that the "before" version has a fog score of *25* (25th grade reading difficulty), while the "after" version has a *14* (14th grade). And most important, the second version *leaves out nothing important.*

Most managers and technical people are wordy — and they know it. Fortunately, though, theirs is an easy problem to solve.

There are others, however, who do not use too many words; they use far too few. True, their writing is lean and tight. But it is so compressed that no one but the writer can understand it! ☐

NEXT TIME: Too Few Words

Special editions for Apple, Atari and TRS-80 Computers.

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Hey kids, are the folks out of the room? Good, 'cause I've got a secret to tell you. You know that computer they fuss over? Well, kid, between you and me, this whole programming thing is a lot simpler than they realize.

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Just so the folks and your teachers won't feel left out, there's a special section for them. It gives detailed lesson ideas and tells them how to fix a lot of the small problems that might pop up. Hey, this book is just right for you. But you don't have to take my word on that. Just listen to what these top educators have to say about it:

Donald T. Piele, Professor of Mathematics at the University of Wisconsin-Parkside says, "**Computers For Kids** is the best material available for introducing students to their new computer. It is a perfect tool for teachers who are learning about computers and programming *with* their students. Highly recommended."

Robert Taylor, Director of the Program in Computing and Education at Teachers College, Columbia University states, "it's a good idea to have a book *for chidren.*"

Not bad, huh? Okay, you can let the adults back in the room. Don't forget to tell them **Computers For Kids** by Sally Greenwood Larsen cost only $3.95. And tell them you might share it with them, if they're good. Specify edition on your order: TRS-80 (12H); Apple (12G); Atari (12J).

Your local computer shop should carry **Computers For Kids**. If they don't ask them to get it or order by mail. Send $3.95 payment plus $1.00 shipping and handling to Creative Computing Press, P.O. Box 789-M, Morristown, NJ 07960.

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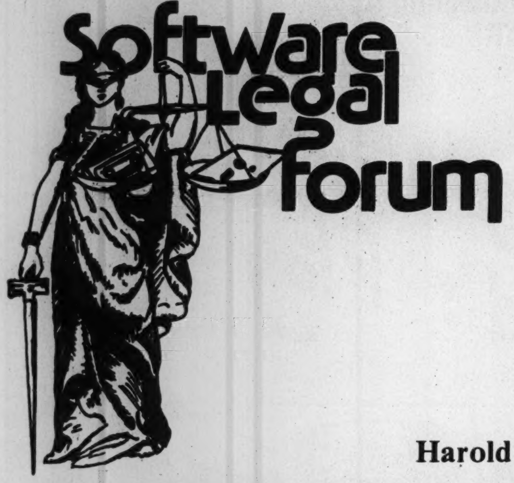

Software Legal Forum

The comments and opinions of the author are given for educational purposes only and are not meant to be legal advice. Specific legal questions should be referred to your personal attorney.

Harold L. Novick

The discussion about the copyright controversy involving computer programs continues this month. Last month, guest columnist, P. V. Piescik, gave his views about the copyright state of affairs and discussed the trial judge's decision in the so-called CompuChess case. That decision was appealed and the appellate court recently published its decision. This month's *Forum* continues the dialog and sets forth a rebuttal to Mr. Piescik's views.

The factual background for the recent exchange of views began in the fall of 1977 when Data Cash Systems, Inc. (DCS) began marketing a computer chess game called CompuChess. The computer program that operated the computer was "capable of receiving the player's instructions, determining the computer's possible legal moves, choosing among the permissible moves in accordance with tactical principles, and displaying the computer's move" (Appellate court's description of the program). The program was stored in a ROM which DCS believed could not be copied and the entire game was packaged in a convenient case.

In late 1978, JS&A Group, Inc. began selling its JS&A Computer Chess which was manufactured in Hong Kong and used a ROM that was identical to and concededly copied from, the one used by DCS. DCS then filed a lawsuit for copyright infringement and unfair competition.

After hearing legal arguments relating to motions to terminate the lawsuit, the trial judge ruled that there was no copyright infringement because a ROM was not a "copy" under the copyright laws. Neither DCS nor JS&A had argued this point and the judge reached his conclusion solely on his own. The trial judge made several other amazing rulings which were the apparent basis for Mr. Piescik's pessimism. However, in order to understand the significance of the trial judge and the appellate decisions and, to put Mr. Piescik's pessimism in perspective, it is necessary to provide some background information.

The old copyright act was originally enacted in 1909 and for all matters of present importance, remained unchanged until it was replaced by the new copyright act which generally became effective on January 1, 1978. Under the old act there were three classes of works. A work (e.g. a book) was automatically federally copyrighted after it was "published" with a proper copyright notice. Generally, "publication" consisted of a public sale or public distribution of the work. The copyright notice, which is the same under the new act, consists of the word "Copyright" or the abbreviation "Copr." or the symbol "©"; the year of first "publication" of the work, and the name of the copyright owner. However, if a work were "published" without the copyright notice, then except for very restrictive exceptions, the work is irrevocably dedicated to the public. The third class or possibility under the old act was that the work was embodied in some tangible form, but was not "published." Such a work was not protected by the federal copyright law but was covered under each state's common law copyright. In an over-simplification, this protection was basically akin to that provided by the law against misappropriation (i.e., stealing).

On January 1, 1978, when the new act became effective, each of the three classes was treated separately. If a work were in the public domain, free for anyone to use, then the new act had no effect. If a work were protected by a federal copyright (i.e. published with notice), then the new act changed the life of the copyright. Under the old act the life was a 28 year term renewable once for another 28 years. Under the new act, if the copyright were in its first term on January 1, 1978, its second term, if applied for, is extended to 47 years (for a total of 75 years). If the copyright was already in its second term, the term was automatically extended from 28 years to 47 years. Finally, if a work were unpublished and hence subject to the common law copyright, the new act automatically provides federal copyright protection as though the work were created on January 1, 1978.

For all works created on or after January 1, 1978, the new act applies, and the work is copyrighted without any formalities as soon as it is "fixed" in a tangible medium of expression for more than a transitory duration. Thus, in contrast to the prior law, under the new act a work need not be "published" for it to be copyrighted. Just as important, if the new work were published without the copyright notice, the copyright may still be saved under some liberal savings clauses.

With this background, what happened in the CompuChess case? The trial judge ruled that although the copyright infringement lawsuit should be brought under the new act (presumably because JS&A first sold its chess game with the copied ROM after the new act became effective), the new act did not apply! He said this because section 117 of the new act "does not afford to the owner of copyright in a work any greater or lesser rights with respect to the use of the work in conjunction with (computer systems) than (the "law" in effect on the day before the act became effective." Since the new act did not apply, he opined, he had to look to the prior law and under the prior law the ROM was not "a copy." If a ROM was not a copy, then there was no copyright viola-

---

Harold L. Novick, Patent Attorney, Larson, Taylor and Hinds, Arlington, Virginia 22202.

tion in reproducing the ROM. The trial judge said much more including that even if the new act did apply, the ROM was still not a "copy."

It is believed the trial judge made several clearly erroneous rulings. First, the judge said that the translation of the programming language (i.e. the source code) into machine language was the development of an "assembly program." Wrong! He next said that the assembly language was "unintelligible except by the computer itself." Wrong again! He then said that an "object code" is "a conversion of the machine language into a device commanding a series of electrical impulses." Since when?

In this author's opinion, the most grievous error was the reason the judge gave for holding that the new act did not apply. The act of infringement was the duplication of the object code stored in the CompuChess ROM into one stored into the JS&A ROM. The act of infringement in this case did not involve the *use* of the computer program; it involved the copying of a work. The work was "fixed" in a material object from which the work could be perceived with the aid of a computer. This is the new act's definition of a "copy." Under the judge's reasoning, he should have ruled that the new act did apply. The second most grievous error was the judge's failure to appreciate that the object code is a translation of the source code, and therefore was presumptively copyrightable subject matter.

In all fairness, however, it has been argued by some that a ROM is not a "copy" in the same sense that an electronic circuit is not a copy of its electronic schematic. One can copyright a schematic and prevent others from photocopying that schematic. However, one cannot use the copyright law to prevent another from building the circuit depicted in the schematic. The water gets even muddier when it is realized that many integrated circuits including ROM's are manufactured by using photographic techniques. Is not a ROM just an electronic circuit? The trial judge apparently thought so. This author does not. A functional test should be used. Can one use a machine or device to "read" the ROM? Does the ROM store *information* that is retrievable? Of course. Therefore, a ROM should be a copy.

Unfortunately, the appeals court that reviewed the trial judge's decision did not explicitly reject any of the lower court's erroneous statements. Although the appellate court upheld the trial judge's statement that there was not a copyright infringement, it did so for entirely new reasons. It seems that when DCS first sold its CompuChess in 1977 (i.e. first published it), it did not use any copyright notice. Over 2,500 games were sold before the new act became effective and "(n)owhere on the ROM, the game board, the packaging, or the accompanying instructions was there a copyright notice." Furthermore, if the contents of the ROM were dumped, no copyright notice would appear because none was there. DCS did not use a copyright notice because "it did not know that it was possible to read the program as (JS&A) did, if one had only the ROM. Too bad, ruled the appellate court. DCS *published* without notice and thus dedicated the ROM to the public.

If this column were to stop here, a great disservice might be done to the readership because of an interesting anomaly. Under both the new law and the old law, the live performance of a song or a play is not a publication; the giving of a live speech is not a publication; the live showing of a T.V. program is not a publication. Nothing is embodied in a "copy" that is "sufficiently permanent or stable to permit it to be perceived . . . for a period of more than transitory duration." Therefore, the live performance of a play does not dedicate, invalidate or forfeit any copyright, whether it is federal copyright or state common law copyright. It follows that since the appellate court held the sale of the ROM without notice was a forfeiture of the copyright, the ROM had to be a "copy." No copy, no forfeiture. Thus, the trial judge was inherently reversed on his holding that the ROM was not a copy.

Mr. Piescik concluded that the precedent established by the trial judge made all software effectively unprotectable. However, that judge's decision is not binding on any other judge. Because neither DCS nor JS&A argued either before the trial judge or before the appeals court that a ROM was not a copy, it is doubted that another judge would give much weight to that holding. Thus, Mr. Piescik may not have anything to worry about. DCS, you do have to worry. If you appeal to the Supreme Court and argue that the ROM is a copy, you may lose because of dedication of the ROM to the public. If you argue that a ROM is not a copy (and hence no publication, no dedication), then the product in JS&A computer chess is not a copy and not an infringement.

Next month, there will be a report on the oral arguments before the Supreme Court in the cases involving the patentability of computer programs. The oral argument was held on October 7, 1980, and a decision should be forthcoming in early 1981. In the interim, if you have computer programs in ROM, publish with notice if you believe ROM's are copies; don't sell them at all if you believe they are not copies. If you don't know, don't live in Las Vegas, and you must sell the program, store the program on magnetic tapes, paper tapes, floppy diskettes, etc., but not on ROM's. ☐

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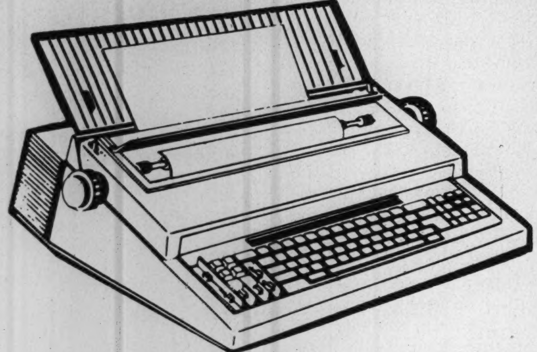

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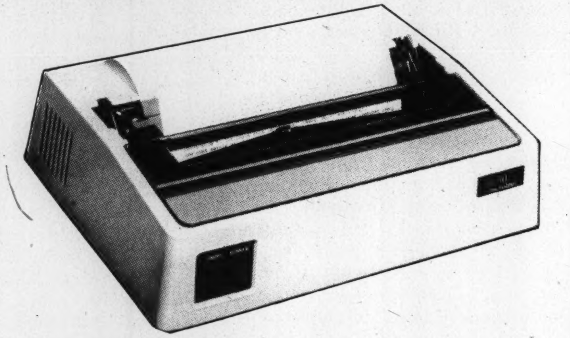

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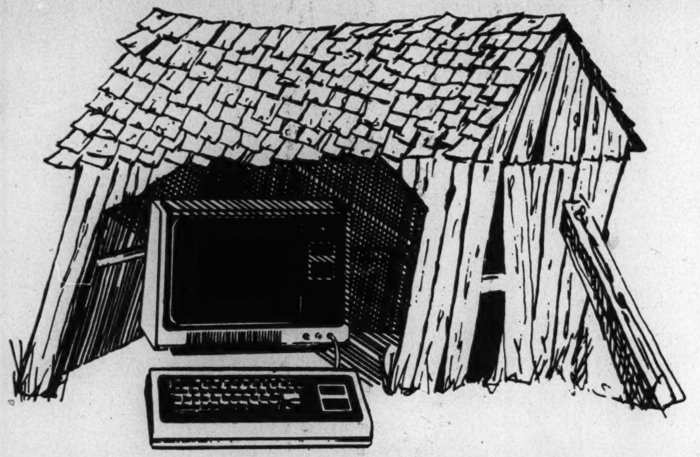
TRS-80 Strings

Stephen B. Gray



For TRS-80 column number 11001, 31, 19 or 25, depending on how you count, we take a very long look at a bunch of ways to create graphics, and short looks at a book on the TRS-80 ROM and a brief program that displays the contents of the ROM.

Six Ways to Graphics

If you have a Level II TRS-80, you can create graphics in at least six different ways:

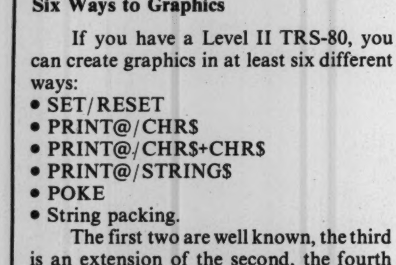
- SET/RESET
- PRINT@/CHR$
- PRINT@/CHR$+CHR$
- PRINT@/STRING$
- POKE
- String packing.

The first two are well known, the third is an extension of the second, the fourth and fifth are used by many, and the sixth first appeared in TRS-80 publications over a year ago.

SET/RESET

The SET/RESET method of creating TRS-80 Level II graphics is explained fairly well on page 8/1 of the Level II manual.

If you want to create a small box (Fig. A) for a game, you have at least three ways to do it with SET/RESET graphics. Either the horizontal bars extend as far as possible, as shown in the "exploded" version in Fig. B, or the vertical bars extend as far as they can go (Fig. C).



Figures A, B, C.

Or you can create a solid white rectangle with SETs, and then make a "hole" in the center with a few RESETs.

You can create the "compressed" equivalent of Fig. C, with a result that looks like Fig. A, using this:

```
100 CLS
110 FOR X=61 TO 66
120 SET(X,22):SET(X,24)
130 NEXT X
140 FOR Y=22 TO 24
150 SET(60,Y):SET(67,Y)
160 NEXT Y
```

Or you can make a dark hole in a white rectangle with:

```
10C CLS
110 FOR X=60 TO 67
120 FOR Y=22 TO 24
130 SET(X,Y)
140 NEXT Y:NEXT X
150 FOR X=61 TO 66
160 RESET(X,23)
170 NEXT X
```

The problem with both these programs is that although they do the job, the small box can't be moved to another location on the screen without having to write a whole new bunch of instructions for each new location.

If you wanted to move that small box around the screen as part of a game, you could use variables, such as

```
110 FOR X=A TO B
```

but the resulting program would be quite complicated, if you insist on using SET and RESET. Also, this is the slowest method for creating graphics, because SET/RESET turns on (or off) only one graphics block at a time.

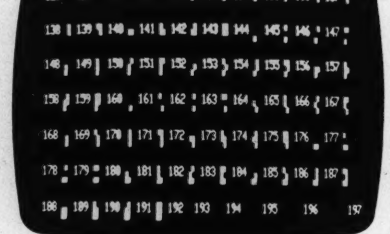
PRINT@/CHR$

A much faster way of creating TRS-80 graphics is by using the 64 graphics characters. These characters are made up of six graphics blocks, and because the entire character is turned on all at once, instead of a block at a time, creating graphics this way is six times as fast as with single-block graphics blocks.

All you need is a chart to figure out which number from 128 (all six blocks off) to 191 (all six on) to use when creating graphics this way. Or you can use this program to figure out which is which:

```
100 CLS
110 A=128
120 FOR X=A TO A+9
130 PRINT X;
140 PRINT CHR$(X);
150 NEXT X
160 PRINT:PRINT
170 A=A+10
180 IF A>190 GOTO 200
190 GOTO 120
200 GOTO 200
```

which gives you the full set of graphics characters along with their code numbers (and which appeared in a longer version in *Creative,* Nov. 1979, p 179).



Graphics Characters

With the chart, or the video image, it doesn't take long to see that the small box can be created by using only four of these characters: 183 (looks like a C), 179 (center pair off), 179 (center pair off), 187 (upside-down C).

Now the program is much shorter, using PRINT@ and CHR$

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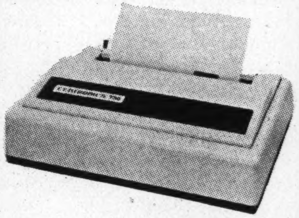

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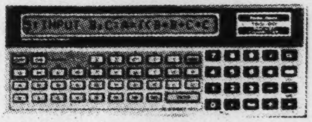

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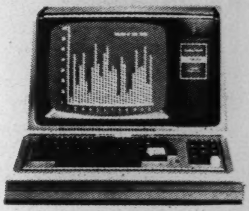

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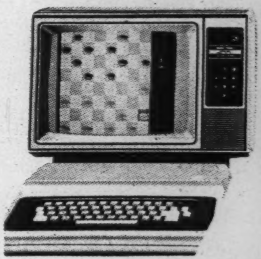

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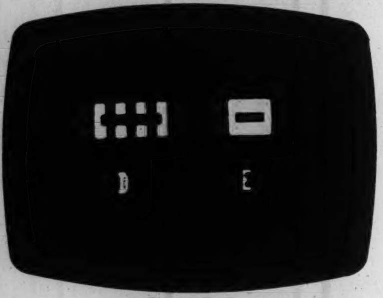
CIRCLE 163 ON READER SERVICE CARD

TRS-80, cont'd...

```
100 CLS
110 PRINT @ 412,CHR$(183)
120 PRINT @ 413,CHR$(179)
130 PRINT @ 414,CHR$(179)
140 PRINT @ 415,CHR$(187)
```

If this version of the small box were "exploded" it would look like Fig. D, but if "unexploded," then it would look like Fig. E, which is just like Fig. A. But now it's made with four program lines instead of six.



Figures D, E

PRINT@/CHR$+CHR$

Somewhere along the line, somebody discovered that a figure like the small box could be created in a single line by just running the CHR$ pieces together with plus signs, which is called concatenation:

```
100 CLS
110 PRINT @ 412,CHR$(183)+CHR$(179)
    +CHR$(179)+CHR$(187)
```

Another version of this is

```
100 CLS
110 A$=CHR$(183)
120 B$=CHR$(179)
130 C$=CHR$(187)
140 PRINT @ 412,A$+B$+B$+C$
```

If you're wondering why the dollar (string) signs are used after A, B and C, try removing them and see which error message you get.

Note that assigning individual graphics characters to strings, as in lines 110-130, isn't practical in most cases, because too much program space is taken up needlessly.

Now we're ready to move the small box around the screen. All you've got to do is make the location a variable, and change it in a predetermined sequence:

```
100 CLS
110 A$=CHR$(183)
120 B$=CHR$(179)
130 C$=CHR$(187)
140 FOR Q=0 TO 900
150 PRINT @ Q,A$+B$+B$+C$
160 NEXT Q
```

The only problem with this program is that it fills the screen with a perforated sheet of white, which is not what was wanted. To make the small box move across the screen without leaving a trail, the small box has to be erased right after each time it's turned on. This can be done by adding

```
155 PRINT @ Q,"
```

There should be eight spaces between the two quotation marks. Try using less than eight, and see what happens.

Also, try changing line 140 to

```
140 FOR Q=0 TO 900 STEP 8
```

and then try a step of 6 or 12, or other number instead of 8, to see how this affects the "flitting" of the small box.

Note that you could also assign the concatenated four strings to a fifth string, which would simplify moving the small box around:

```
135 D$=A$+B$+B$+C$

150 PRINT @ Q,D$
```

PRINT@/STRING$

Page 5/7 of the Level II manual says that STRING$ (n,character) "returns a string composed of n character-symbols." So to start the small box with a pair of horizontal lines, use four of graphics character 179, which has the top and bottom pairs of blocks lit:

```
100 CLS
110 PRINT @ 410,STRING$(4,179)
```

The two missing blocks can be filled in, prosaically, with

```
120 SET(52,19):SET(59,19)
```

As created here, the small box is difficult to move around the screen. Can you rewrite the program, using STRING$, to create a more easily manipulated box?

POKE

The basics for POKE graphics are explained briefly on page 8/5 of the Level II manual, which says that "POKE is about 6 times faster than SET" and that for Level II graphics, "it is very important ... to stay in the range for display locations," which in display memory is 15360 to 16383.

So to print the small box in the middle of the screen, use this:

```
100 CLS
110 POKE 15835,183
120 POKE 15836,179
130 POKE 15837,179
140 POKE 15838,187
```

Or this variation on the same theme:

```
100 CLS
110 FOR X=15835 TO 15838
120 READ D
130 POKE X,D
140 NEXT
150 DATA 183,179,179,187
```

String Packing

Now we come to the most complicated method of creating screen graphics with the TRS-80. Actually, it isn't all that complex, except where variable pointer VARPTR is used.

But first let's step back a bit and look at ordinary strings. You can assign just about anything on the keyboard to a string, simply by putting the alphanumerics in quotes, such as

```
A$="ABC"
```

That string can now be manipulated with a variety of operators. But suppose you want to create and manipulate a string consisting of one or more of the 64 graphics characters. These characters could be easily assigned to a string, if they could be input directly from the keyboard.

That is, if Radio Shack had wanted the TRS-80 to be highly graphics-oriented. The design engineers could have added two more shift keys to the keyboard, plus some more electronics, and then assigned the 64 characters to keys, two to a key — because there are 64 graphics characters and only four dozen keys that could be used.

So either the manual would contain an assignment list, or two graphics keys would be engraved on the top or front of each of 32 keys. Commodore did something like that on the PET, putting graphics characters on some of the keys.

But Radio Shack didn't, no doubt to keep costs down. However, there's a way to put graphics characters in a string. It's called string packing, and it was discovered by Leo Christopherson, whose Android Nim *(Creative,* June 1979, p 125) and Dancing Demon (Oct. 1980, p 178) programs are extraordinary.

The idea is simple: You assign blanks to a "dummy" string, as many blanks as you want graphics characters in the string. Then you look into memory to find out where the computer stored the string. And then you just poke the graphics codes into the string.

TRY THIS ONE!

We read with interest in the June 1980 issue of *Omni* that Daniel Shine is offering a $100 prize for the first person to provide the solution to this problem:

A large number of points are randomly placed in a square. What is the probability that any randomly chosen point is the nearest neighbor to its nearest neighbor, i.e., that it forms with its nearest neighbor a pair such that each is the nearest neighbor to the other? It is easy to determine that the answer is less than two thirds, but what is it exactly?

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TRS-80, cont'd...

So first you assign four blanks to the dummy string

```
100 CLS
110 A$='    '
```

or you can use "XXXX" or "1234"; it doesn't mater, because they'll be replaced by the characters you POKE into the string. If you're using a string more than six or seven characters long, then it's better to fill it with numbers, as in D$="1234567 89012", to help make sure you create a string of the exact length desired.

Then you put into a DATA statement the graphics codes for the four graphics characters

```
120 DATA 183,179,,179,187
```

Next you find the place in memory where the computer has stored the first of the four blanks, using variable pointer VARPTR

```
130 X=PEEK(VARPTR(A$)+2)*256
    +PEEK(VARPTR(A$)+1)
```

Page 8/8 of the Level II manual gives basic information on VARPTR, but because it's a reference manual, doesn't show how to use it.

Let's do some math in calculator mode on the TRS-80. First RUN lines 100-130, then input

```
PRINT PEEK(VARPTR(A$)+2)
```

and you get 66, which is the most significant byte (MSB) of the string-value starting address. You multiply this by 256 to shift it over into the high end of the 16-bit byte-pair, and you get 16896.

To this you add

```
PRINT PEEK(VARPTR(A$)+1)
```

which is the least significant byte (LSB) of the string-value starting address, in this case 241, and you get the complete decimal address 17137, which is what you get if you try

```
PRINT X
```

This decimal address, 17137, is the address into which you poke the first of the four graphics codes in the DATA statement using

```
140 FOR I=0 TO 3
150 READ J
160 POKE X+I,J
170 NEXT I
```

This pokes 183 into address 17137, 179 into address 17138, etc. To try out this program, enter lines 100-170, RUN it, and then simply enter

```
PRINT A$
```

A great deal of memory space is saved using this string-packing technique, which is important if you're trying to squeeze a complicated animation program such as Dancing Demon into 16K. About a third less space is used, compared with using string elements such as CHR$(183). Hang on for further details.

If you LIST this program after RUNning it, you'll find that line 110 has changed from

```
110 A$='    '
```

to something quite different and much longer:

```
110 A$='AUTOCONTCONTNEW'
```

This is because the computer thinks that in this particular context, the numbers 183, 179 and 187 are tokens.

Tokens

When you enter a Basic program into your your Level II TRS-80, the computer doesn't store words such as VARPTR, CLS and DATA in that form, but saves space by translating them into digital tokens. The token for AUTO is 183, for CONT is 179, and for NEW is 187.

The computer can do this because character codes 128 through 191 are used for graphics commands, and 192 through 255 for space-compression codes, and would never be used in Basic statements. So these values, 128 through 255, can be used to store one-character values for each of the words or symbols reserved for Level II Basic.

The computer, not knowing any better, instead of printing out the graphics codes, prints the tokens, making programs written with string packing seem to have been written with tokens.

As an exercise, you might try to figure out how to program graphics using tokens instead of graphics codes 128 through 255. Can it be done?

Bytes and Bits

Just in case the math involved in turning the MSB and LSB into a decimal memory address didn't make much sense to you, let's look into the binary equivalents.

If the most significant byte of the string-value starting address is 66, and the least significant byte is 241, why not just place them together to get that starting address? That would be 66241. Unfortunately, it's not as simple as that.

In combining 66 and 241 to make 66241, what we've done is to change 66 into 66000 and then add 241. This would be all right if the computer's internal language, the language understood by the digital circuits, were decimal. But it's binary.

So you have to take the 66 and multiply it by a binary number to move it over to the left far enough to make room for the 241. This is the binary equivalent of what was done in decimal fashion in the preceding paragraph, multiplying 66 by 1,000, so as to have room for adding in the 241.

The two bytes, the most significant and the least significant, are each eight bits long. So you have to multiply the MSB by a figure that will move it eight spaces to the left, to make room for adding in the LSB, and thus generate the 16-bit address needed for packing.

Multiplying a binary number by 2 will move it one space to the left (just as in decimal numbers, multiplying a number by the base, 10, will move the significant digits one space to the left). Multiplying a binary number by 4 moves it two spaces to the left, etc. Multiplying it by 256, which is 2^8, will move the MSB eight places to the left.

Thus multiplying 66 by 256 produces essentially the same pattern of bits as in binary 66, but with eight zeroes trailing after it, and that trailing portion is where binary 241 goes. Or, in binary:

```
                 MSB       LSB

16896 = 01000010|00000000
 +241 =         |11110001
----------------|--------
17137 = 01000010|11110001

                 66        241
```

Inside Level II

This is the title of a 70-page paperback, subtitled "A Programmer's Guide to the TRS-80 ROMs", that shows an assembly-language programmer how to use the routines already resident in the ROMs, and how to link assembly language and Basic programs to write a single program that combines the best features of both languages.

The book is $15.95, plus .75 postage, from Mumford Micro Systems, Box 435-B, Summerland, CA 93067, if you can't find it at your local computer store.

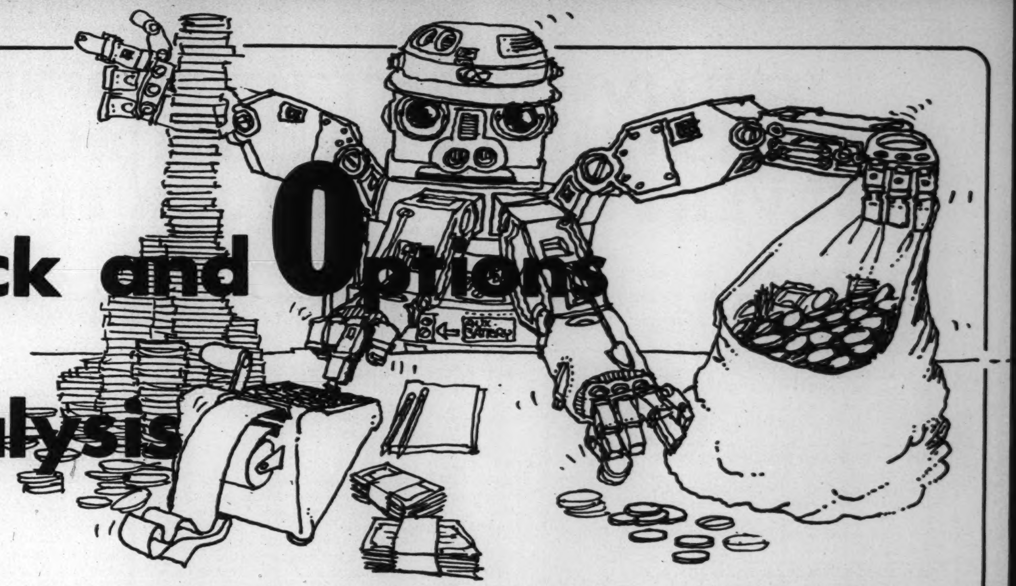
Short Program #14

A short program that "displays the contents of the ROM" was sent by Michael Rutenberg of Kingston, Ontario, Canada. He writes:

"It does this without at the same time messing up the screen with control characters such as CHR$(23), CHR$(28), etc. It does this by poking the character into the screen instead of using the PRINT routine." ☐

```
10 '  THIS PROGRAM DISPLAYS ROM MEMORY WITHOUT MESSING UP THE
20 '  SCREEN WITH CONTROL CHARACTERS ETC...
30 '
40 DEFINT A-Z
50 PRINT STRING$(20,13)    'CLEAR SCREEN AND SET LINE POINTER
60                         'TO BOTTOM LINE OF IT
70 FOR AD = 0 TO 32767
80    PP = AD - INT(AD/64) * 64    'AD MOD 64,  0 <= PP <= 63
90    POKE 16320 + PP, PEEK(AD)    'DISPLAY LOCATION
100   IF PP = 63 THEN PRINT        'SCROLL SCREEN IF END OF LINE
110 NEXT AD
120 STOP : END
```

Stock and Options Analysis



Keep the data you need to make timely investment decisions at your fingertips with this incredibly powerful investment tool. Considerable effort has gone into methods of tilting the odds in the investment game. Out of this has come the discovery that the strategy of hedging listed options against common stocks can tilt the odds drastically. In fact, it can be *more conservative* and *more consistently profitable* than the simple buying and selling of stock.

The four programs in this package are designed to be used in the real world, and include the effects of commissions, margin interest and dividends, where applicable. Possible investment attitudes, the listed option markets, puts and calls and option strategies are covered in extensive documentation.

The program **Opgraph** presents important indices of both opening and closing call option transactions. The manual includes sample runs illustrating combination strategies with covered and uncovered calls, and covered and uncovered straddles recieve detailed treatment.

The **Option** program presents a graph or a table, as the user chooses, of profit from any combination of six basic positions: long or short a stock, long or short a call and long or short a put. Sample runs are presented which cover hedging with calls, out-of-the-money hedges and in-the-money hedges.

Newprem enables the user to predict the future premiums of an option at whatever time and future stock price the user selects. This method requires the establishment of a data base of historical option premiums in whatever detail the user desires.

Finally, **Portval** enables the user to determine on an item by item basis, the cost, current value per share, total current value and capital gain of a portfolio consisting of long and short stock, and long and short option positions. This program assists the user in keeping a readily available and easily updatable record of his portfolio and, at the same time, assists him in measuring his progress towards financial success.

In order for an investor to continually improve his performance it is necessary for him to refer to past performance; this requires useful records. Finally, he should constantly be evaluating his performances to assure himself he is playing the right game.

The **Stock and Options Trading Analysis** package is available for the 32K TRS-80 Level II on cassette (CS-3306) and disk (CS-3801) for $99.95. Creative Computing Software should be available at your local computer store. If your favorite retailer does not stock the software you need, have him call our retail marketing department at the number below. Or you can order directly from Creative Computing Software, Dept AGII; P.O. Box 789-M, Morristown, NJ 07960. Visa, MasterCard, or American Express are also welcome. For faster service, call in your bank card order toll free to 800-631-8112. In NJ call 201-540-0445.

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LEDGER 2 - builds and updates the JOURNAL TRANSACTION file.

LEDGER 3 - lists both the the JOURNAL file and the CHART OF ACCOUNTS.

LEDGER 4 - computes the TRIAL BALANCE and executes POSTING of journal transactions into the CHART OF ACCOUNTS. An AUDIT TRIAL of all transaction is output.

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MICROPAY

An Accounts Payable system, MICROPAY includes the following program & functions:

PAY 1 - initializes both Transaction and Master files, then begins the Accounts Payable process by inputting and adding records in the Transaction file.

PAY 2 - allows for changes and deletions of Transaction and Master records.

PAY 3 - reports outstanding Accounts Payables in four categories; under 30 days, 31-60 days, 61-90 days, and over 90 days.

PAY 4 - reports all outstanding Accounts Payables for a single customer or for all customers, and computes Cash Requirements.

PAY 5 - reports all outstanding Accounts Payables for a single date or for a range of dates and computes the Cash Requirements.

PAY 6 - lists both the Transactions and Master files.

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An Accounts Receivable system, MICROREC includes the following programs and functions:

REC 1 - initializes Accounts Receivable files, adds A/R record and prints invoices.

REC 2 - accepts receipt of customer payments and changes or deletions of A/R Transaction or Master file records.

REC 3 - reports outstanding Accounts Receivables in four categories; under 30 days, 31-60 days, 61-90days, and over 90 days.

REC 4 - reports all outstanding Accounts Receivables for a single customer, or for all customers and computes Cash Projections.

REC 5 - produces reports for all outstanding Accounts Receivables for a single date or for a range of dates and computes Cash projections.

REC 6 - lists Transaction and Master files and accumulates and journalizes Accounts Receivables, creating JOURNAL entries which communicate with the MICROLEDGER JOURNAL file. **$140.00**

MICROINV

This Inventory Control system presents a general method of Inventory Control and produces several important reports. Its program includes:

INV 1 - initializes Transaction and Master files and adds and updates Transaction and Master records.

INV 2 - handles inventory issued or received, creating inventory records. This program also accumulates and journalizes transactions, producing JOURNAL entries which communicate with the MICROLEDGER file.

INV 3 - lists both Transaction and Master files.

INV 4 - produces the STOCK STATUS REPORT, showing the standard inventory stock data and stock valuation, and the ABC ANALYSIS breaking down the inventory into groups by frequency of usage.

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PERS 3 - lists an Employee Master Record or the entire Employee Master file; lists a single Payroll Record or the entire Payroll file.

PERS 4 - computes Payroll and prints the PAYROLL REGISTER. Prints PAYCHECKS and creates JOURNAL entries to be fed into the MICROLEDGER JOURNAL file.

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Outpost: Atari

George Blank

Intercepted message from an unidentified suborbital earth vehicle on stardate 1980.360/0120Z

```
10 GR. 7
20 C. 3
30 PL. 40,65
40 DR. 120,65
50 DR. 80,5
60 POS. 40,65
70 POKE 765,3
80 XIO 18,#6,0,0,"S:"
90 C. 2
100 PL. 76,6
110 DR. 85,2
120 DR. 75,2
130 DR. 83,6
140 DR. 80,0
150 DR. 77,6
160 PL. 79,3
170 DR. 81,3
180 SE. 0,12,2
190 C. 1
200 F. Y=78 TO 82
210 PL. Y,65
220 DR. Y,80
230 N. Y
240 PR.,
250 F. X=1 TO 15
260 REA. Y
270 PR. CHR$(Y);
280 N. X
290 D. 77,101,114,114,121,32,67,104,
114,105,115,116,109,97,115
```

Transmission Report

TO: All Outposts

FROM: Headquarters

SUBJECT: Defective message traffic from Outpost Atari

TEXT: The following difficulties have been reported in previous transmissions from Outpost Atari:

Report of August 1980 — "For Apple HLIN and VLIN are for lo-res only. For hi-res HPLOT TO is as good as anything Atari has." Fred Gerlach, Houston, TX

Report of September 1980 — "You said that a USR machine language routine was needed for timer accuracy: no need! Merely calculate time twice (2 sets of PEEKs); if they differ by more than one second, loop until they don't." Wilson Dillaway, Johsonville, NY.

"You stated that one should NOT put more than 40K of RAM into an Atari 800 because the last 8K is used for ROM cartridges. The Atari is a sophisticated machine and will allow access to the last 8K of RAM if there are no cartridges present, and to 4K of that if only one cartridge is present. For Atari VisiCalc we strongly recommend the additional memory" Bob Frankston, VisiCalc Co-author.

Programming Hint

With the powerful screen editing capabilities of the Atari, there are times when you want to edit some lines frequently. For example, you might want to try different color hues and luminances until you get the ones that look best. Here is a routine that allows you to RUN your program, then press enter to LIST it. The RUN is printed at the end of the list so that you can just press RETURN on that line to restart.

```
20000 DIM XX$(1):INPUT XX$
20010 GRAPHICS 0:LIST:PRINT"RUN":END
```

Philosophical Essay — Computer Comparisons

One of the most serious illnesses in our national thought process is our philosophical bent toward positivism. Positivism is the attempt to reduce all of life to numbers, so that is can be compared mathematically. This virulent American disease tends to overvalue that which is easily quantifiable, and overlook that which is difficult to express mathematically.

For example, I know of a law firm that would have been able to use a small computer profitably, but decided not to buy because other law firms in the area had minicomputers. The decision was made, not on the basis of ability to do the job, but strictly on the basis of price tag. For this lawyer to buy a less expensive computer would be to lose face with his competition. Price is easily quantifiable. An Atari computer system might cost $3,000 while an IBM system might cost $300,000. While this certainly out to be considered in a purchase decision, the abilities of the individual computer is a far more important decision.

In our typically American positivistic way, we have sought to quantify the abilities of different computers. Certainly, some good tests have been established, giving us benchmarks and price-performance ratios. But this is often carried to the point of ridiculousness. Does it really matter that Brand X can sort a 1000 element array in 22 seconds while Brand Y takes 29 seconds? It might, if you are going to spend a lot of time waiting for your computer to sort 1000 element arrays. However, there are probably circumstances in which it might be more sensible to buy Brand Y because it comes in a color that matches the rest of the office!

I am not saying that we should ignore quantitative data in the purchase of a computer. I certainly don't. For example, I think that the length of the warranty period, the number of nearby service centers, the cost of service, and a lot of other quantitative information is helpful in a computer purchase. But I think people who are comfortable with computers have a special tendency to rely too much on numbers.

Probably the best way to test a computer is actually to use it. You will probably find some things you really like, and other things you hate. For example, I am currently typing this article on a non-Atari microcomputer. With it's sharper definition of letters, longer text lines, and excellent word processing software, the other computer is a better choice than the Atari for word processing. However, I find times when I can barely tolerate the other com-

George Blank, Foster Road, Milford, NH 03055

puter. Perhaps the biggest annoyance is shoddy power supplies that constantly hum and buzz. The Atari is much better built. In addition, the other computer generates so much television interference that I can only use the Atari when the rest of the family is home.

Recently, at *SoftSide* magazine, we have discovered an excellent stress test for comparing computers subjectively. It is the process of trying to write an entire program in a single line. Please note that I am not recommending this as good programming practice. Programming in one line is highly dependent on fancy tricks and does not make for elegant or easy to read programs. But it does rapidly show up certain strengths and limitations of the particular computer.

With the Atari, we have found it possible to put a program in a single line that includes continuous graphics, sound effects, and imaginative use of color. We have also found that the Atari is wasteful of memory space, and we really miss having IF .... THEN .... ELSE construction. We have also discovered a lot of fascinating tricks that are also bad programming practice. Among the tricks are using POKE instead of SETCOLOR to set colors and using abbreviations to write lines that are so long that they cannot be edited because the Atari expands them to fill more than three lines.

There is a great temptation to use numbers when we have a computer available, because the computer can produce such elaborate reports. But I strongly request that we resist the positivistic impulse, and a good place to begin our resistance is in the decision to buy the computer in the first place. Let us save our society from inundation in meaningless statistics! ☐

THE SMITHS
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SPOT, KITTYKAT, MOUSE,
FINNY FISHY, AND, THEIR
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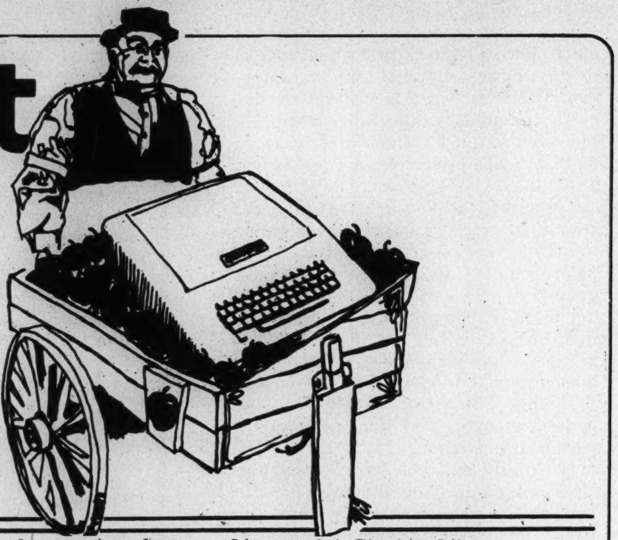


Chuck Carpenter

Correspondence is always welcome and a response will be made to those accompanied by a SASE. Send your letters to: Chuck Carpenter, 2228 Montclair Pl., Carrollton, TX 75006.

Season's Greetings. Seems odd to be saying that this time of year (4 Aug '80). We've had over 40 days of temperatures greater than 100 degrees. This column will be devoted mostly to a number of things you may want to get or give for Christmas. Or if you didn't get some things you wanted, the items included here might round out your stocking. Also, in Figure 1, you will find my rendition of the complete (more or less) Apple II memory map.

Books

6502 Software Design
By Leo J. Scanlon
Sams #21656, $10.50

This is a new book in the Blacksburg series and probably the best book for beginners. Even though the AIM 65 was used as the demonstration system, the information is useful for any 6502 system. The more than 90 programming examples are thoroughly described starting with the simple and progressing to the complex.

Chapter 1 provides a discussion about the history and the significance of the 6502. The characteristics of the device are described and so are the features of the AIM 65 Microcomputer. Chapter 2 begins a thorough treatment of the 6502 instruction set. A summary of the instruction set is first, then a presentation of the thirteen 6502 address modes. Other chapter sections break the instruction set into 9 related groups. In chapters 3 and 4, subroutines, and lists and lookup tables are presented. Subroutines include nesting, data moving and time delays. Lists and tables include unordered lists, sorting, ordered lists, lookup and jump tables. Chapters 5 and 6 include the mathematical routines. This is the first book I've seen that doesn't bog you down with computer mathematics until the chapters where it's used. Really pleasant. All types of mathematical functions are included here. Programs for the basic four functions along with all sorts of conversions from one number base to another are included.

Interrupts and resets are presented in chapter 7. These are the features that let you control the outside world while running your favorite program. The Nov. '80 *Apple Cart* column provided explanation and applications of these 6502 features too. Chapters 8 and 9 discuss how to connect the 6502 to all sorts of input/output (I/O) devices. Some of the popular internal hardware devices are discussed along with familiar external peripherals. There's plug-in hardware now available for the Apple that lets you do some of the I/O things described here. The Appendix includes a summary of the ASCII character set and a detailed summary of the entire 6502 instruction set. This was a refreshing change too since other books have been entirely devoted to the instructions without explanation of how to use them.

The Blacksburg series includes two other books I found extremely helpful for learning about machine language programming. They are titled *8080/8085 Software Design* parts I and II. The subject of assembly language programming is very well presented. And, even though the architecture of the micro's is different, the techniques are similar. If you were to read these first, then read *6502 Software Design*, you would be very well versed in the subject.

Introduction to Low Resolution Graphics
By Nat Wadsworth
Scelbi Publications, about $15.00

This book is a summary of low resolution graphics for the TRS-80, Commodore (PET) and Apple II computers. Most of the programs are written for the Apple II making it of use to Apple owners. It is a good book for use by the newcomer. There are 5 chapters including Getting Started, A Whole Chapter on Math, Drawing Simple Shapes, Drawing Lines, and A Graphics Library.

Radio Teletype Apples

Radio Amateurs who are interested in Radio Teletype (RTTY) and morse code (CW) operation will be interested in a new hardware and software package, *Integer Basic*. The package includes a circuit board containing narrow band FM detection and generation circuitry and CW keying and detection circuitry. I used the software a few years ago when it was first available from Chris Galfo. He has since teamed with Alex M. Massimo who is marketing the complete hardware/software package. The package is intended for the experienced operator who understands the theory and operation of RTTY and CW. Once connected to your radio equipment, the screen of the Apple II becomes a display of messages being sent and received. The screen is divided into three separately scrolling areas. The top section displays 16 lines of messages received, the bottom section shows the last 5 lines of the output message buffer, and the middle line displays, in billboard fashion, the text as it is being transmitted. The software provides customizing functions so you can do those things like CR, LF and LTRS in RTTY and ID's and your station setup in RTTY and CW. The package called RADCOM PLUS +, is $190,000 for the circuit board, an *Integer Basic* software disk (It used to be available on tape too) and documentation. For more information contact Alex M. Massimo — AF6W, 4041 41st Street, San Diego, CA 92105.

Software By Phone

The Software Connection has added at least 3 more programs. You can now get by phone, a *Phone Secretary*, *Computer Calculator*, and *Phone Chess*. The *Phone Secretary* lets you automatically dial a list of phone numbers. You can also log incoming calls on your computer. The

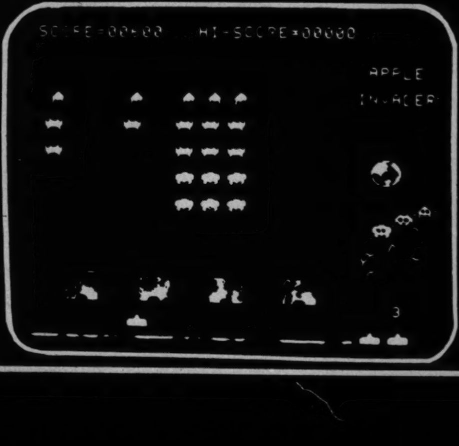
SPACE WAR

FLOOOOOM
WHOOOMPH
KROW

You're in command in **SPACE WAR!** Destroy your opponent's ship by forcing him to collide with the sun or to explode upon re-entry from hyperspace -- or challenge him face to face with missile fire. You're in command of the speed and direction of your ship. You control the timing of your missiles. You select the game mode from five options, including Reverse Gravity, and the battle begins. Accelerate to place your shots--and escape into hyperspace before your opponent comes within range. But be wary, he (or she!) may circle out of sight and reappear on the opposite side of the galaxy! (This is the classic MIT game redesigned especially for the Apple.)

and SUPER INVASION

- **Super Invasion** is the original invasion game, with the original moon creatures and faster action than any other invasion game.
- Features superb high resolution graphics, nail-biting tension and hilarious antics by the moon creatures!
- Self-running "attract mode" of operation for easy learning and demonstrating of the game.
- As good in every way as the famous Invaders arcade game.
- High speed action ! • Sound effects!
- Runs on the Apple II and the Apple II Plus



Fifty-five aliens advance and shower you with lethal writhing electric worms. As you pick off the aliens, one-by-one, they quicken their descent. They whiz across the screen wearing away your parapets, your only defense, coming closer and closer to your level. **Super Invasion** is the **original** invasion game with the original moon creatures and faster action than any other invasion game on the market.

Super Invasion is available for only $19.95 on cassette (CS-4006) for a 32K Apple II. **Space War** is $14.95 on cassette (CS-4009) for a 16K Apple II. **Space War** and **Super Invasion** are on one disk (CS-4508) for a 48K Apple II for only $29.95.

Send payment plus $1.00 shipping and handling to Creative Computing Software, P.O. Box 789-M, Morristown, NJ 07960. NJ residents add $1.00 sales tax. Bankcard orders may be called in toll free to 800/631-8112. In NJ call 201/540-0445.

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creative computing software

Computer Calculator provides you with the capabilities of a 98 function calculator. There are many options with the calculator program to let you save or print-out the results of your calculations. *Phone Chess* provides the capability for you to play chess with a friend over the phone. Only one of the players needs to have the program. Use your accoustic or direct modem to capture the programs on your initialized diskette. You need to have Applesoft in ROM (or language card), and the system doesn't like the autodialer programs in use on some machines. Make sure your first program is the free TSC autodial program; this one is compatible. The Telephone Software Connection's modem can be reached at (213) 329-3715, 24 hours a day.

Apple II Resource

WIDL Video is publishing the most complete directory of products and sources of information for the Apple I've seen. The book is not a catalog and you can't order things from it. But you don't need to get copies of all the magazines to find things for your Apple. As indicated by the following quote, the company is dedicated to promoting the Apple II computer.

"If you are considering the purchase of a personal computer and have not as yet made your choice, we recommend the Apple II very highly over every other mini computer currently on the market. The features, quality, and overall value of the Apple are, in our opinion, outstanding. It has the ability to grow and expand as your needs change because its excellent design was built around modular concepts. The standard Apple contains eight built-in connectors that allow you to add a variety of languages, printers, floppy disk drives, modems for telephone communication, and many more."

"If you are undecided, we feel that the Apple is an excellent choice. See your local Apple dealer today for a full demonstration. Feel free to contact us if you have further questions. We will attempt to answer them as best we can without selling you anything, as we do not sell the Apple. We only believe in the product."

Included in the contents of the book are 13 categories of Apple resources. These include Boards, 34 entries covering do-it-yourself hobby boards, special interface boards, communications boards, video digitizing boards, the 80 column video boards and much more. There are 4 Music board entries, 36 Peripherals and devices, 17 Accessories, 10 sources for expanding Storage, and 7 more Resources And Supplies entries to help you find things. Other contents include Books, Magazines And Publications, Special Apples (incouding an Arabic Apple), Time Sharing Systems, User Groups, Software Producers And Sources and Authorized Apple Dealers.

Most of the entries are up-to-date. I noticed some that are no longer around and some that are incorrect. The directory is dated Spring 1980 so it's quite possible there have been some changes. As always, the buyer beware approach is best. I would estimate the contents are better than 90% correct, making the book an excellent Apple information resource. Call or write to the specific listed company if you're not sure about the current status. *The Resource Directory* is available for $4.95 postpaid from WIDL Video, 5245 West Diversy, Chicago, Illinois 60639 (phone (312) 622-9606).

Lower Case Adapter

Dan Paymar has had his adapter on the market for some time now. By plugging-in an adapter board and a couple of chips, you can have upper and lower case on the screen. Unlike other lower case generators, the Paymar adapter does not use a lot of your program memory to generate the characters. The hardware adapter extends the Apple's normal text display to a full 96 ASCII set, including lower case letters with descenders. In addition you gain 5 additional symbols including right and left curly brackets and vertical dashes.

The adapter includes Integer Basic demonstration software and machine language software is available. Several of the word processors are compatible with the adapter, including Super-Text, the one I am now using. Installation is not difficult but may be tricky in some of the newer Apples. You may have to remove the case in order to plug in the adapter. The adapter is $64.95 (June '80) from Enhanceware, 91 Pioneer Place, Durango, CO 81301.

Serial IO Board

A low-cost serial board is available from Electronic Specialties. The board is RS-232 compatible and includes the DTR (Data Terminal Ready) signal for handshaking. Software residing in memory — usually page 3 — is required to run the board. As received, the software is for slot zero. Information is included to let you make changes in the calls for other slots. Since the language cards use this slot you will want to do this. I was told that the software is available on tape and possibly diskette. If you include the software in your hello program, you can load it each time you start-up your system. The speed adjustments are made by changing components values, and tuning of the timing is required. Software for making the adjustments using your computer is also included. Also as supplied, the software sets the printing width to 72 characters. A POKE to the width address can be used to change it as required. Even though the board is simple in design, I have used it and found it quite effective. As a general purpose I/O board in my development system, it is more than adequate. You can get a board only with instructions for $15.00, a kit of all the parts for $42.00 or a completely assembled and tested unit for $62.00. For more information contact Electronic Systems, P.O. Box 21638, San Jose, CA 95151 (phone (408) 448-0800).

S-C Assembler II Update

S-C Software has announced The Disk Version 4.0 Upgrade Kit. There is also a new 4.0 tape version that will work with any Apple II. For those of you who now have the S-C Assembler the upgrade kit provides many new features including considerably increased assembly speed (for whatever reason you might need it). Here are the new features.

New Editing Features

- ability to append source programs from disk or tape.
- automatic line numbering
- parameterized RENUMBER
- memory usage display
- escape IJKM with or without Autostart ROM
- tabs set up for 6-char labels
- star-dash line automatic generation
- no conflict with D.C. Hayes modem

New Assembly Features

- multiple source files using .IN directive.
- object code direct to disk using .TF directive.
- listing on and off using .LIST OFF and .LIST ON.
- .PG to issue form feeds during listing
- .BS to reserve a block of storage
- tremendous speed increase
- labels up to 32 characters
- labels may include periods
- local labels
- after an assembly error the line is listed
- .EQ values and .BS addresses are printed on the listing.
- assembler and DOS memory is protected during assembly
- symbol table printed in alphabetical order

The 20-page update manual includes detailed descriptions and examples of the new features. Also included are memory usage, Specific ROM entry points for routines used with the assembler, and a bibliography of sources for 6502 information. The new manual brings the total manual pages to over 60. In addition, the new update includes a programmer reference card. The card includes a quick reference to all the Assembler commands, directives, a memory map, ASCII chart, relevant DOS commands, the 6502 opcodes, Apple's Sweet 16, sixteen bit

SOFTWARE for TRS-80 MODEL I & II

- ★ General Ledger, C.P.A.
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$240.00 each

Quality business software written especially for the Radio Shack computers. These are not Osborne programs.

Submit blank diskette for sample report printouts.

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CIRCLE 271 ON READER SERVICE CARD

Find Your Way Around The New Apple® DOS With The Dakin5® Programming Aids 3.3®

Dakin5 Corporation, a Colorado software house, is making available to the public 12 utility programs on one 16 sector diskette, utilizing the new Apple DOS 3.3, which provides 23% more storage.

All of the Dakin5 Programming Aids 3.3 programs are also compatible with the Corvus Disk Drive system.

Features

- Remove REM statements, unreferenced (dead) code, and compress code to increase program speed and save memory and disk space.
- Copy any file or program from one diskette to another. Only the name is needed.
- Print or display a line cross reference and variable name cross reference.
- Print or display all or selected records from a text file.
- Display any sector of a given file or program, and then update any data within that sector, or specify the sector you wish to update, such as directory sectors and sectors occupied by DOS.
- Create, print and modify your own text and Exec files.
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- Copy a diskette without DOS; initialize without DOS; verify source diskette; verify copied data is the same as the original.
- Use a powerful data entry routine that handles both string and numeric data.

Plus Many More Utility Programs for Sophisticated Programmers

Many of these utility programs have been developed and tested for in-house use while producing The Controller™ business package for Apple Computer Inc.

Each programming aids package includes a program diskette and very complete documentation, all attractively packaged in a padded, blue print vinyl 3-hole notebook with silver lettering. An identifying tab separates each program for convenient reference.

See your Apple dealer or contact Dakin5 Corporation, P.O. Box 21187, Denver, Colo. 80221. Telephone: 800-525-0463. VISA or MC welcome.

Apple is a registered trademark of Apple Computer Inc. The Controller is a registered trademark of Dakin5 Corporation.

DAKIN5 CORPORATION

CIRCLE 122 ON READER SERVICE CARD

GALAXY SPACE WAR I

Galaxy Space War 1 (WAR1) is a game of strategy in which the player has complete control of his space fleet's tactical maneuvers. Each fleet battles its way toward the opponents galaxy in an attempt to destroy it and win the war. WAR1 simulates the actual environment encountered in a space war between two galaxies. Optimum use is made of Apple's high resolution graphics (HIRES) and colors in displaying the twinkling stars universe, the colored ships of each fleet, long range sensors colored illuminations, and the alternating blinking colors used in battles between ships. Complementing HIRES are the sounds of war produced by Apple's speaker.

WAR1 is played between Apple and a player or between two players. You may play with total knowledge of each others fleet or only ships sensor knowledge of the opponents fleet. Each player builds his starting fleet and adds to it during the game. This building process consists of creating the size and shape of each ship, positioning it, and then allocating the total amount of energy for each ship.

During a player's turn he may dynamcially allocate his ships total energy between his screen/detection and attack/move partitions. The percentage of the total energy allocated to each partition determines its characteristics. The screen/detection partition determines how much energy is in a ship's screens and the detection sector range of its short range sensors. The attack/move determines the amount of energy the ship can attack with, its attack sector range, and the number of sectors it can move in normal or hyperspace.

When an enemy ship is detected by short range sensors, it is displayed on the universe and a text enemy report appears. The report identifies the ship, its position, amount of energy in its screens, probable attack and total energy, a calculated detection/attack/move range, and size of the ship. Also shown is the number of days since you last knew these parameters about the ship. When a ship's long range sensor probes indicate the existence of an enemy presence at a sector in space, this sector is illuminated on the universe.

An enemy ship is attacked and destroyed with attack energy. If your attack energy breaks through his screens, then his attack energy is reduced by two units of energy for every unit you attack with. A text battle report is output after each attack. The program maintains your ship's data and the latest known data about each enemy ship. You may show either data in text reports or display the last known enemy positions on the universe. You can also get battle predictions between opposing ships. The text output calculates the amount of energy required to destroy each ship for different energy allocations.

APPLE® II, 48K, APPLESOFT
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WAR1 DISK & MANUAL ...$39.95
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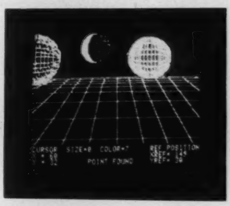


$24.95 DISK & MANUAL

THE DESIGNER is a user oriented APPLESOFT program that does the HPLOTing for you. Sometimes referred to as the 'poor man's graphics tablet', it places lines and complex circular functions on the APPLE HIRES screen with the use of game controls and single key-strokes. 2 page animations, disk save and recall, and simple cursor-driven executions are among the features of this crash proof program.

REQUIRES 48K APPLE/APPLESOFT ROM/DISK

AVAILABLE FROM YOUR DEALER OR DIRECT FROM
APPLE — JACK, BOX 51, CHERRY VALLEY, MA 01611
(INQUIRIES INVITED)

CIRCLE 106 ON READER SERVICE CARD

Apple, cont'd...

interpreter opcodes and a list of useful I/O addresses. The card, priced at $2.50, is included with the 4.0 update but is worth the price to have it just for the information it contains.

Since there are now several options for the S-C Assembler II, here is a list of the options and prices.

- old cassette version (requires I/B), $25.00
- version 3.2 disk, $35.00
- upgrade old cassette to 3.2 disk, $12.50
- upgrade from 3.2 disk to 4.0 disk, $22.50
- complete new 4.0 disk, $55.00
- complete new 4.0 tape, $45.00
- upgrade 4.0 tape to 4.0 disk, $12.50

Each version includes appropriate manuals and diskettes or tape. Note that the old tape version requires that you have Integer Basic; either in the original version or the Integer Basic language card. The S-C Assembler II was reviewed in the July '80 column and the point about the tape version requiring I/B was missed. For more information contact S-C Software, P.O. Box 5537, Richardson, TX 75080 (phone (214) 324-2050). Don't forget with the S-C Assembler, it's easy to learn, use and remember.

Game Paddle Extender

Have you ever wanted to have more game paddles? Or, have you wanted to plug other gadgets into the game paddle connector? If so, here's a little kit that can help you make those extra connections. The kit consists of an extender cable and a circuit board. Six, sixteen pin sockets can be mounted on the board. One of the sockets has the pins connected so you can connect 4 game paddles at the same time. Sorry folks, there are only 3 switch inputs just the same. I mounted the board on a small plastic cabinet that I bought at Radio Shack. The sockets came from Radio Shack too. With this adapter/extender, you can plug in a variety of gadgets and circuits. My serial printer program and connections remain plugged-in now. And, I don't have to switch plugs with the game paddles either. You can use other connectors to supply signals for any other devices you want to connect too. Just make sure there is no conflict with the input/output pins, and that the current drawn from the 5-volt pin does not exceed 100ma. You can get the adapter kit from CDS INC., 14222 Dallas Parkway #1104, Dallas, TX 75240. The cost is $9.95 post paid.

Apple's Support Policy

Comments from readers in recent letters indicated a lack of support from Apple. I wrote a letter to Phil Roybal, an executive at Apple, for a clarification of the current policy. Here is Phil's unedited reply . . .

Dear Chuck,

Thanks for your letter asking about our approach to customer problems. I enjoy your column, and appreciate the opportunity to respond to questions in it. Here's what's happening.

I set up the Hot-Line in early 1978 to help customers with applications problems. Since then the Hot-Line crew has grown to 5 full-time people. But in the same time the user base mushroomed to well over 100,000.

How could we service that number of people efficiently? Our answer has been three-fold:

1. EDUCATE THE DEALER BASE

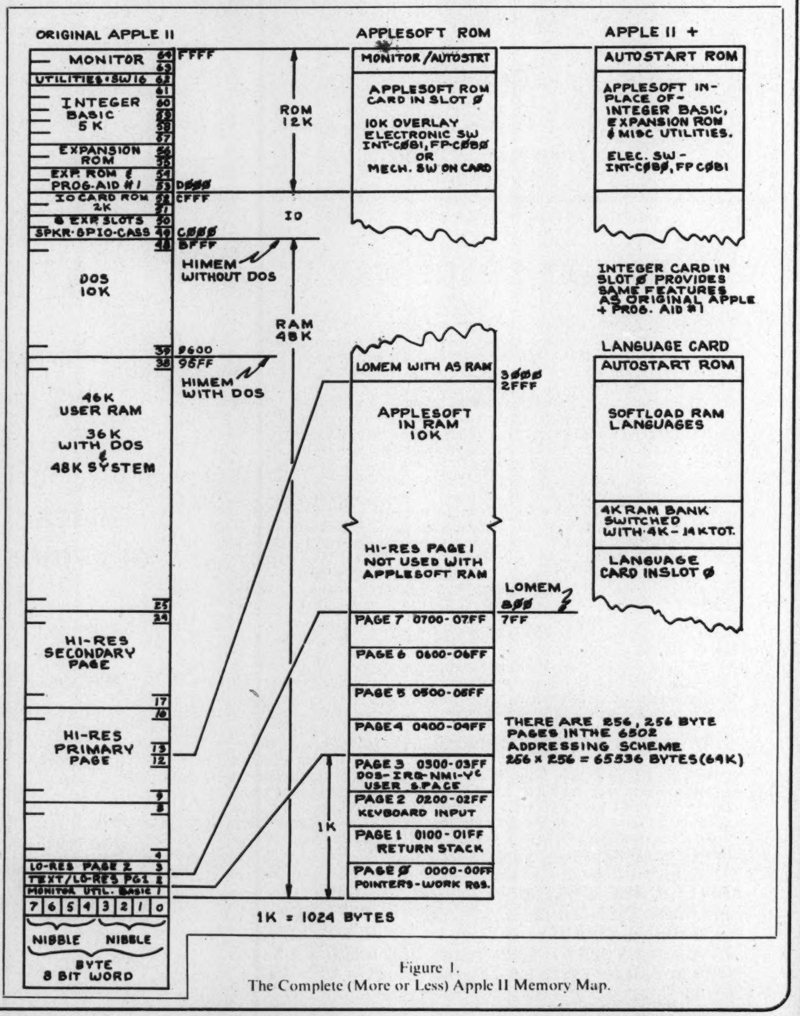
Dealers are our first line of contact with the public. We depend upon them heavily for customer technical support. (And they are compensated for this in the profit they make from a computer sale.) Through newsletters, demos, and training programs like APPLE MEANS BUSINESS, we have provided a lot of tools and motivation for learning our products in the past six months.

The results of this training are beginning to show. In the last 4 months, the percentage of dealer calls to the Hot-Line have tripled. That means more knowledgeable dealers (who learned the answers and thus have them when you need them), and less traffic tying up the line (because answers are available locally) when you call.

2. MOVE SUPPORT INTO THE FIELD

It has been hard to get through to the factory for a while, due to the volume of incoming calls. So we are moving support outside, closer to the dealers.

We are now building Field Applications Support groups in each Area Sales Office across the U.S. These groups will perform the traditional Hot-Line function for their territories, while the headquarters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MONITOR
UTILITIES·SW16
INTEGER BASIC 5K
EXPANSION ROM
EXP. ROM & PROG-AID #1
IO CARD ROM 2K
8 EXP. SLOTS
SPKR·GPIO·CASS
DOS 10K
46K USER RAM
36K WITH DOS & 48K SYSTEM
HI-RES SECONDARY PAGE
HI-RES PRIMARY PAGE
LO-RES PAGE 2
TEXT/LO-RES PG1
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CFFF
C000
BFFF
9600
95FF
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IO
RAM 48K
HIMEM WITHOUT DOS
HIMEM WITH DOS
1K
1K = 1024 BYTES
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MONITOR/AUTOSTRT
APPLESOFT ROM CARD IN SLOT 0
10K OVERLAY ELECTRONIC SW INT-C081, FP-C080 OR MECH. SW ON CARD
LOMEM WITH AS RAM
3000
2FFF
APPLESOFT IN RAM 10K
HI-RES PAGE 1 NOT USED WITH APPLESOFT RAM
LOMEM
800
7FF
PAGE 7 0700-07FF
PAGE 6 0600-06FF
PAGE 5 0500-05FF
PAGE 4 0400-04FF
PAGE 3 0300-03FF DOS-IRQ-NMI-V^C USER SPACE
PAGE 2 0200-02FF KEYBOARD INPUT
PAGE 1 0100-01FF RETURN STACK
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THERE ARE 256, 256 BYTE PAGES IN THE 6502 ADDRESSING SCHEME 256 x 256 = 65536 BYTES (64K)

Figure 1.
The Complete (More or Less) Apple II Memory Map.

group concentrates upon writing application notes, digging up technical information, and keeping the field informed. We have already hired people in two areas, and will soon put them through formal training. The dealers should see the effect of their presence by October.

3. SUPPORT USER GROUPS

Apple has strongly supported the International Apple Core and its member groups, and encourages all new users to seek out and join such groups. We will continue to do this, because we know that there's no better source of detailed information than an enthusiastic and knowledgeable user.

Dealers are paid to support products, not just to supply them. Apple offers an ample margin to cover a dealer's efforts, and expects that users will insist upon a certain level of support from retailers they give their business to. So when you ask how a mail-order customer gets help, the answer is the same as it is for any other user: he goes first to his dealer.

We've gone through a period of incredibly rapid growth, and the user base temporarily outgrew our ability to support it. But I have a strong commitment to keeping Apples productive in the field. This requires timely, accurate technical information. Our goal is to provide that information through retailers, backed up by Field Applications Engineers, backed up by the central support team.

Sincerely,
Phil Roybal
Mgr. Communications Programs

There you have it. I find it to be a reasonable approach. Remember, if you are having problems, make sure your dealer provides the necessary help. They are charged with the responsibility by Apple. As I have mentioned in the past, be rational. You won't get much help by being unreasonable. With as many circuits as there are in an Apple it is unavoidable that things will go wrong. Being firm but tactful will help solve the problems quickly. ○

Apple II Memory Map

Figure 1 is my rendition of current memory use in the Apple II. RAther than clutter the map with all the memory boundaries, only key reference addresses are included. The addresses are hexadecimal. For more information, refer to the *Apple II Reference Manual.* Once again, Happy Holidays. ☐

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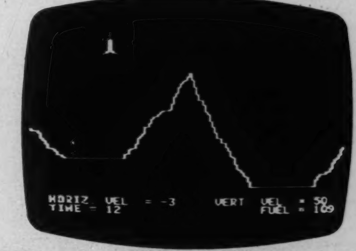

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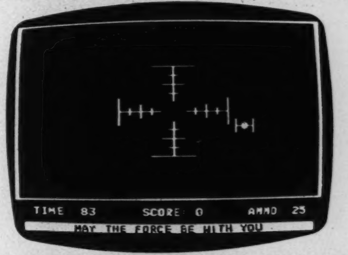

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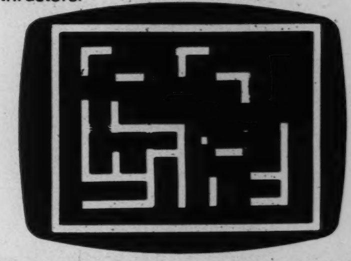

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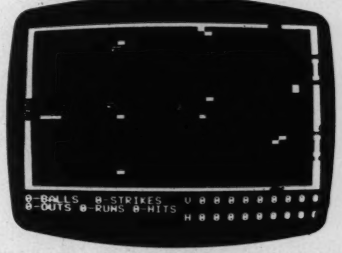
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0-OUTS 0-RUNS 0-HITS H 0 0 0 0 0 0 0 0 0

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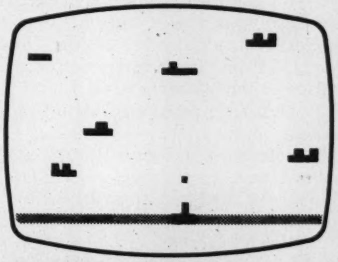

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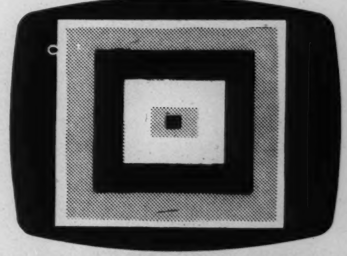

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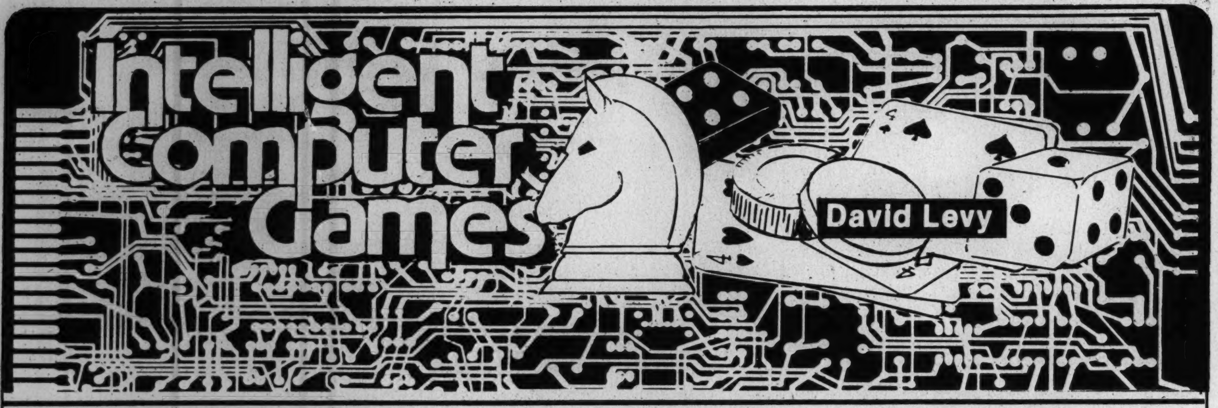

> Correspondence is welcome. Letters with interesting questions and ideas will be used in the column along with a response. No personal replies can be made. Send to: David Levy, 104 Hamilton Terrace, London NW8 9UP, England

CHESS (Part 2)

This month we shall continue our historical survey of the most important milestones in mainframe chess programming.

The first program of the modern generation was written at M.I.T. by Richard Greenblatt, a student, and two colleagues. Work on the program began in November 1966, and by April the following year it had scored two wins, two draws and no losses in a tournament with human players. Based on statistics given in Greenblatt's paper, I would estimate that his program, at that time, was stronger than any commercially available chess machine currently on the market. The name of his program was MacHack VI.

MacHack employed a plausible move generator containing some 50 heuristics. The program was intelligent enough to know that certain heuristics were not always applicable, but depended on the nature of the position. In this way, moves selected by the plausible move generator were not always exactly the same set of moves as those which would have been chosen by a linear evaluation function. From this aspect of MackHack's decision process the programmer can learn an important trick — it is often useful to use one evaluation mechanism (or set of heuristics) to select the plausible moves for the tree, and another one for performing the evaluation of terminal nodes.

The plausible move generator made its decisions by considering the moves themselves, rather than the positions arising after the moves were made. For example, if a move is bad because it blocks the line of attack of another of the player's pieces, the program would recognize the fact rather than look at the resulting position and say to itself "Hey! This position is bad because my bishop is blocked." By accepting or rejecting moves for the plausible move list in this way, the program saved a great amount of computation.

During the plausible move computation, each square of the chess board was assigned a measure of importance, corresponding roughly to the estimated value of having an extra piece attacking that square, or the cost of moving away a piece which currently attacked that square. The most important criteria used for assigning these values included how near the square was to the center of the board or to the enemy king, and whether or not the square was occupied by one of the program's pieces which is under serious threat.

The value of a piece in strategic terms (as opposed to its actual material value) was related to the number of squares it attacked, i.e., its mobility, and to the number of enemy pieces that it attacked. These strategic values were computed for the piece in its old and new locations, and a strategic gain was taken as an indication that the move should be on the plausible move list. In other words, if a move appears to put a piece on a better square, that move is worth further examination.

The program encouraged certain types of attack on squares that were considered possible weak points, for example weak pawns, pinned pieces, and pieces defending other pieces. Moves which fell into these categories were also added to the plausible move list.

MacHack performed an alpha-beta search, with forward pruning. The plausible move generator would select a certain number of moves at each level of lookahead, and add to this number any moves which satisfied certain conditions: All safe checks were examined; at the first and second plies all captures were investigated; the moves of a certain number of distant pieces are examined, so that the program would not ignore most of the board if all of the moves of a single piece were highly plausible. The minimum number of moves selected by the plausible move generator was normally 6 at each level of lookahead, but in tournament mode, i.e., when playing at a rate of 2-3 minutes per move, the program would examine a minimum of 15 moves at the first two ply, 9 moves at the next two ply, and 7 moves at each subsequent level. Only when the minimum number did not exist (for example when one side was in check or had only its king on the board) would the search be narrower, though of course the alpha-beta algorithm would often prune away branches on which there were plausible moves.

One of the few advantages that mainframe programmers have over those writing for a micro, is the availability of enormous backing store. This enables a program to employ transposition tables, which are advantageous in preventing the program from evaluating the same position more than once. In chess, as in many other games, it is frequently possible to reach the same position by different routes, and we call this phenomenon transposition. As a simple example, if White makes move A, Black makes move B, and White then makes move C, we shall reach the same position as if White had made his moves A and C in the reverse order. MacHack produced a hash value for every position evaluated in the tree search, and together with this value the program stored the score for the position and a note of the depth of search at which the evaluation took place. If the position is created again during the search, the program would not recompute the score for the position but would take it from the value scored together with the hash for that position. Even though MacHack stored only 32,000 positions in hashed form, it was able to save considerable computation time, and as a side benefit, it was quickly able to detect draws by repetition.

The MacHack program represents the first really significant milestone after Shannon's paper, because it was the first

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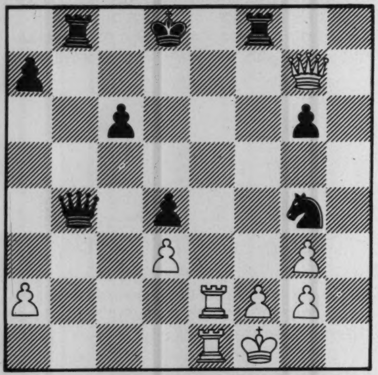
Games, cont'd...

program to make good use of the Shannon-B strategy. The strength of the program in 1967 was extremely impressive, and created considerable publicity for computer chess amongst the computing and chess fraternities. This publicity served as the impetus for many of the groups which started programming around 1967 or '68, for example the Slate/Atkin/Gorlen group at Northwestern University and Newborn at Columbia University. In fact, Greenblatt and his colleagues probably did as much for computer chess in 1967 as Shannon had done almost twenty years earlier.

I should like to offer you two examples of the playing strength of the Greenblatt program. The first is a position which was shown to several strong American chess players, including some Masters, and defeated a number of them.



This position is a win for Black, who has an extra knight for a pawn. But the task is to find a quick win. If White is allowed to survive he might conjure up counterplay based on the exposed position of the black king and the weakness of black's pawns on g6 and a7. How can Black force a quick win?

MacHack discovered the correct continuation:

1 . . . f8–f2+

For the program to play this move it must have been able to see 9-ply ahead, in the crucial variations.

2 f1–g1

The alternative was 2 e2–f2 g4–h2+ 3 f1–e2 (or 3 f1–g1 b4–e1+ 4 g1–h2 e1–f2, when Black is a rook ahead) 3… b4–b2+ 4 e2–d1 b2–b1+ 5 d1–e2 b8–b2 mate.

2 . . . f2–e2
3 g7–h8+ d8–c7
4 h8–f6 e2–e1+
5 Resigns

To show that a computer program is a good chess player, it is not enough to give an example of its tactical prowess. The very best programs are extremely adept at tactical combinations, but are often let down by their poor strategic understanding. So the proof of the whole pudding must lie in an examination of complete games. The following is the first game ever won by a computer program in a chess tournament. Its opponent was rated 1510 on the U.S.A. rating scale, equivalent to a weak club player. The game was played in the Massachusetts State Championship, 1967.

WHITE: MacHack VI
BLACK: Human
1 e2–e4 c7–c5
2 d2–d4 c5–d4
3 d1–d4

MacHack knew no openings at that time, and plays very much as many of today's commercially available machines. This type of opening is bad for White because it allows Black to bring out his pieces "free of charge," by using developing moves to harass the white queen.

3 . . . b8–c6
4 d4–d3 g8–f6
5 b1–c3 g7–g6
6 g1–f3 d7–d6
7 c1–f4 e7–e5

A dubious decision. The human was obviously worried about the possible advance of the white pawn from e4 to e5, but Black should have continued 7 . . . f8–g7, and if e4–e5, then f6–h5, attacking White's bishop.

8 f4–g3 a7–a6
9 e1–c1 b7–b5
10 a2–a4 f8–h6+ ?

An ineffective move that weakens an important central pawn. One gets the impression that the human felt he could take risks against MacHack.

11 c1–b1 b5–b4
12 d3–d6

Black, when making his 10th move, almost certainly overlooked the fact that on the d6 square, White's queen or rook will fork the two black knights on f6 and c6, thereby rendering harmless Black's threat to the white knight on c3.

12 . . . c8–d7
13 g3–f4 h6–g7
14 c3–d5 f6–e4
15 d5–c7+

Black may have overlooked this response, but in any event his position was hopeless.

15 . . . d8–c7
16 d6–c7 e4–c5
17 c7–d6 g7–f8
18 d6–d5 a8–c8
19 f3–e5 d7–e6
20 d5–c6+ !

MacHack spots a simple queen sacrifice that forces mate.

20 . . . c8–c6
21 d1–d8 mate

A Benchmark Chess Program

It is perhaps worth mentioning, in passing, the work performed by Jim Gillogly during the early 1970s on a program designed to serve as a benchmark for other chess programs. Gillogly's program, which he named TECH, had a very simple program structure which could easily be emulated by anyone using a small computer. Rather than perform strategic evaluation on all terminal nodes in the tree, the TECH program only took a close look at the nodes at the first level of look-ahead. It evaluated all these positions, sorted them into order, and only changed this order if a full width search revealed the forced win or loss of material for a root move. Programs with such a structure can play perfectly recognizable chess, and are tactically quite satisfactory, but they are hindered in their overall playing performance by a lack of strategic depth.

Those of you wishing to start writing chess programs for your own machines could do a lot worse than employ Gillogly's approach. Because strategic evaluation is only carried out on the (say) 30-40 root moves, the program can perform quick full-width search, using the alpha-beta algorithm, to detect forcing variations that affect the material status of the board. Such a program is relatively easy to write, and should perform at roughly the same level as a Chess Challenger, provided that your strategic evaluation function is well thought out.

Gillogly argued that to be of any real merit, a chess program must be able to play better than a TEACH type program, given the same amount of time, because the TECH program did not do anything clever. A really good programmer could probably write a TECH type program in little more than 2K of code (assembler), and I would not be surprised to see a program of that size playing better chess than some of the 8K and 16K cassette programs available to personal computer users today.

Deep or Shallow Search

Not entirely unconnected with the previous section is the question of how essential it is to search the game tree as deeply as possible. There are two distinct schools of thought on the subject; programmers usually prefer to search as deeply as possible, on the grounds that they are more likely to notice neat tactical possibilities; but a minority believe that shallow search, with more attention being devoted to each node, can lead to equally good play. Since human chess players look at a very small tree, this second approach is clearly endowed with some merit, but most chess programmers prefer the exhaustive search technique, possibly because of a lack of confidence in their own ability to create an advanced evaluation function that would be sufficiently sophisticated to perform drastic forward pruning.

Up to now almost all of the world's strongest programs have been the "brute force" type — searching enormous trees but performing relatively little sophisticated evaluation at the terminal nodes. The TECH program is possibly the supreme example of this genre, performing only a

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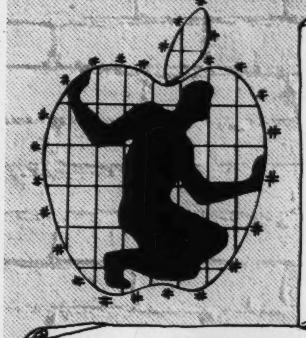

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Games, cont'd...

material evaluation at the terminal nodes. We do not yet have sufficient experience with intelligent chess programs to be able to determine which approach is superior, but I hope that the following game, despite exhibiting rather passive play by Black, will convince the reader that brute force is not the only possible route to a master strength chess program. For those programming chess on a small computer, the intelligent approach offers much scope for original research, and I would like to hear from readers who have any interesting or fresh ideas on this subject.

This game was played in a computer tournament in Dortmund in 1975.

WHITE: Schach MV 5.6
BLACK: Fischer/Schneider
1 b1–c3 d7–d5
2 d2–d4 c8–g4
3 f2–f3 g4–f5
4 e2–e4 d5–e4
5 f3–e4 f5–d7
6 g1–f3 b8–c6
7 e4–e5 e7–e6
8 c1–g5 f8–e7
9 d1–d2 g7–g6
10 f1–d3

So far Black has played rather passively, but White has developed its pieces on sensible squares. White's latest move is, in fact, a mistake, which should lose a pawn to 10 . . . c6–d4 11 g5–e7 d4–f3+ 12 g2–f3 g8–e7, but Black was unable to see this far.

10 . . . b7–b6
11 g5–e7 g8–e7
12 e1–c1 e8–g8
13 d2–h6 !

Immediately beginning an attack against the black king. The threat is f3–g5, followed by h6–h7 mate.

13 . . . e7–f5
14 d3–f5 g6–f5
15 f3–g5 d8–g5+

Giving up the queen was the only way to prevent mate. If 15 . . . f8–e8 16 h6–h7+ g8–f8 17 h7–f7 mate.

16 h6–g5+ g8–h8
17 g2–g4

A fine move, opening up other lines of attack to the black king.

17 . . . f5–g4
18 g5–g4 f7–f5
19 g4–h4 f5–f4
20 c3–e4

Here comes the other knight.

20 . . . f4–f3
21 e4–g5 f8–f7

Again the only way to prevent mate on h7.

22 g5–f7+ h8–g8
23 h4–f6 f3–f2
24 f7–h6 mate

It would be reasonable to deduce, having played over this game, that the program playing the white pieces had a very good idea of what it was doing; that it planned a king-side attack from early on and then executed this attack in a well planned manner. In fact, White did not employ any look-ahead whatsoever. All of its moves were found as a result of a one-ply search. Its king attack feature was obviously well designed, but there was no tree search — the planning was all implicit in the evaluation function. This should provide some idea of just how much *can* be achieved without a deep look-ahead, and I hope that it will encourage some of you to write intelligent programs rather than programs which perform brute force searches of large trees.

The Northwestern Program

To conclude this survey I shall give a brief description of the famous program, written at Northwestern University, by David Slate, Larry Atkin and (in the beginning) Keith Gorlen. This program has won most of the important computer chess tournaments of the 1970s, and the interested reader would do well to read a more detailed account of this program, which may be found in Peter Frey's outstanding book *Chess Skill in Man and Machine.*

The Northwestern University program, whose successive generations have been named CHESS 2.0, . . . CHESS 3.0, . . . CHESS 4.0, . . . CHESS 4.9 (the first digit represents a working generation, the second digit is a version within that generation), was born in 1968. When the first computer chess tournament took place in 1970, the program proved itself to be the strongest, and it maintained this reputation for most of the decade. Occasionally another program would win an event ahead of the Northwestern program, but such occurrences were the exception rather than the rule. At the time of writing, this program holds the title of World Computer Champion, which it took from the Russian KAISSA in 1977. The forthcoming World Championship contest in Linz, Austria (September 25th-29th, 1980) will probably be the toughest event in which the program has participated, and we may even see a new title holder.

Much of the program's power is due to its great speed. The programmers have devoted much effort to the speeding up of essential processes such as legal move generation, and to this end the program maintains a data base which includes, among other things, a list of every square attacked by each piece. This list is updated whenever a move is made in the game tree, and by updating it rather than recreating it, the programmers reduce the time taken to provide the attack and defense lists for the newly created position. The program also uses a hash table for transpositions, as described in the section on Greenblatt's work.

For some time, the Northwestern program employed a plausible move generator to restrict the number of nodes in the game tree, but various reasons prompted the programmers to change to a full width search. One of the prime reasons for doing so was the fact that they noticed certain moves, which appeared good when examined to a depth of (say) 5-ply, but which ranked too low at the root of the tree to be included in the first plausible move list. Chess masters are not faced with this problem because their plausible move generator is much more sophisticated and accurate, and I suspect that the chess programs of the future may return to the plausibility approach, unless brute force searching produces an electronic chess master within the next 2-3 years.

The program's evaluation function contains a number of terms which quantify the best known chess heuristics. Material is measured in such a way as to encourage the side that is ahead in material to exchange where possible, and to discourage the exchange of material if the program is losing. Another feature gives a bonus for attacking enemy pieces, and this bonus is enhanced when an enemy piece is doubly threatened.

Pawn structure is an important feature of the game of chess at higher levels of skill, and any program which aspires to master strength must understand the finer points of pawn structures. If your pawn formation is rotten your whole position is eventually liable to crack under pressure. This program considers doubled pawns (two or more pawns of the same color on one file); isolated pawns (pawns that cannot be supported by pawns of their own color); backward pawns (pawns which do have adjacent friendly pawns, but which are less far advanced than its neighbors); passed pawns (those which have no enemy pawn impeding their progress to the eight rank); and advanced pawns.

Knights, bishops, rooks and queens are given bonuses according to the values of the squares they attack, particularly if the squares are near the enemy king or the center of the board. Rooks are given bonuses for being situated on open files or on the seventh rank (a rook on the seventh rank usually poses a serious threat to enemy pawns which have not yet moved). The kings are discouraged from moving towards the center of the board, except in the endgame, and there is a safety feature which determines whether or not a king is well sheltered by its own pieces.

The tree searching routines employ all of the techniques that we have encountered in previous articles: the alpha-beta algorithm, with a "window," killer moves, etc. In fact the Northwestern program provides us with an excellent illustration of the power of all these neat tree searching tricks — it plays chess better than more than 99.5% of the world's chess playing population, and has even won some quick games against International Masters and Grandmasters. These outstanding results have been achieved more through the effects of a cleverly programmed brute force search than as a result of the program's chess knowledge, which is still primitive. The success of the program shows good programming is even more important than an advanced knowledge of the game, when producing a program of the strength currently being exhibited by small computers. Certainly it will be necessary for a human chess expert to be involved in the programming of an electronic Grandmaster, but there is absolutely no reason why the readers of this column should not write a program that can play respectable chess.

To illustrate the prowess of the Northwestern program I shall offer you the following game, which was its first ever win over a human Grandmaster. The game was played at blitz speed, which requires each player to make all of his moves within five minutes. In fact the rules were slightly different for the two participants — Stean was playing in real time but the program was permitted a total of 5 minutes for CPU time and satellite transmission time, with no penalty for the time taken by its human operator to move the pieces.

WHITE: CHESS 4.6
BLACK: Stean

1 e2–e4 b7–b6
2 d2–d4 c8–b7
3 b1–c3 c7–c5
4 d4–c5 b6–c5
5 c1–e3 d7–d6
6 f1–b5+ b8–d7
7 g1–f3 e7–e6
8 e1–g1 a7–a6
9 b5–d7+ d8–d7
10 d1–d3 g8–e7
11 a1–d1 a8–d8
12 d3–c4 e7–g6
13 f1–e1 f8–e7
14 c4–b3 d7–c6
15 g1–h1

It is peculiar moves such as this one which make it possible to recognize the play of a computer. A strong human player would never move his king onto a diagonal occupied by his opponent's queen and bishop, unless it was forced.

15 . . . e8–g8
16 e3–g5 b7–a8
17 g5–e7 g6–e7
18 a2–a4 d8–b8
19 b3–a2 b8–b4
20 b2–b3

If we sum up what has happened so far, it is clear that Black has a dominating position. His pawns control the center while White's e4 pawn attacks only one central square. Black's pieces are active, White's are passive. But the program has one important advantage — his opponent thinks that to all intents and purposes the game is over, and he tries to take the program's position by storm. This is exactly the opposite of the way one should play against a strong program — the tactical search will reveal tricks that the human misses, especially at this breakneck speed.

20 . . . f7–f5 ?

A mistaken attempt to open up the diagonal to the white king.

21 f3–g5 f5–e4
22 c3–e4 f8–f2

This move appears, at first glance, to be very strong. If now 23 e4–f2, Black's queen immediately gives mate on g2. But the program had seen further in the crucial variation than its opponent.

23 d1–d6 !

When he saw this move Stean exclaimed "Bloody iron monster." The point is that Black's queen is needed to prevent d6–d8 mate, and the queen is attacked. If the queen moves to a square that protects d8, White can then capture the rook on f2. So White must win material.

23 . . . c6–d6

The best try.

24 e4–d6 f2–g2

Threatening to move the rook to g5, c2 or e2, with check from the bishop on b7. Any of these moves would win for Black, but . . .

25 g5–e4

Blocking the crucial diagonal.

25 . . . g2–g4
26 c2–c4

Blocking off another line of attack.

26 . . . e7–f5
27 h2–h3

Stean had hoped for 27 d6–f5 e6–f5, when Black wins the other knight which is pinned against the white king. When the computer played h2–h3 Stean cried out "This computer is a genius."

27 . . . f5–g3+
28 h1–h2 g4–e4
29 a2–f2 !

Yet another tactical blow. Black had only expected 29 d6–e4 g3–e4, when he has sufficient material to make the program's task quite difficult. But this latest move, threatening mate by f2–f7+ and then f7–f8 mate, forces an even greater material advantage.

29 . . . h7–h6
30 d6–e4 g3–e4
31 f2–f3 b4–b8
32 e1–e4 b8–f8
33 f3–g4 a8–e4
34 g4–e6+ g8–h8
35 e6–e4 f8–f6
36 e4–e5 f6–b6
37 e5–c5 b6–b3
38 c5–c8+ h8–h7
39 c8–a6 Black Resigns

There was once a time when leading experts in computer science would say that "Computers can't play chess." □

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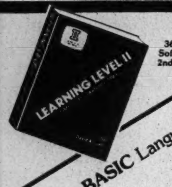

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Reviews

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For instance, in the chapter on Hobby Applications, he discusses briefly several program possibilities, such as random art patterns, design transformation, graphing functions, and then provides a program that creates crossword poetry by writing words horizontally and vertically.

Then he discusses two dozen hobby applications in a little more detail, including Morse code, animated films, astronomy, railroading, etc., and gives two programs, one for calculating the position of Venus, the other for composing music.

The other chapters are on applications in business, math, science, education, games, control, etc. The book includes about 75 programs, many of them quite short, such as seven multi-statement lines for calculating pulse rate (you hit any key for each beat), a dozen short matrix-manipulation programs, and several long programs: data-base management (8½ pages), Star Challenge game (15 pages), baseball (14½ pages).

The programs all seem to be in Microsoft Basic, and should be a good source of material for programmers who write games, or who like variety, or who have run out of ideas.

* * *

TRS-80 Basic, by Bob Albrecht, Don Inman and Ramon Zamora. John Wiley & Sons, Inc., New York. 358 pages, paperback $8.95. 1980.

This is one of the latest in Wiley's three dozen Self-Teaching Guides, which range from money management to flowcharting.

The three authors are editors of *Recreational Computing*, and Albrecht has co-authored three other Wiley Self-Teaching Guides: *Basic, Basic for Home Computers,* and *Atari Basic*.

The gimmick that makes this a self-teaching guide is the division of each chapter into frames. Each frame presents an idea or topic, and ends with questions. You cover the answers, which are just below the questions, and give your own answers before uncovering the authors' answers.

A dozen chapters cover the TRS-80, introduction, simple programs, FOR/NEXT loops, random numbers, Patterns and Games, Entering and Displaying Data, Strings, arrays, editing and debugging, and Graphics, Games and Programs for the Home.

Seven appendixes cover setting up the TRS-80, using the cassette recorder, arithmetic (scientific notation, rounding), error messages, print and graphics layout sheets, reserved words, and ASCII codes.

The book teaches Level II Basic slowly but surely, with many examples and questions. The style is conversational and the writing can easily be understood by a bright pre-teenager, for whom the book seems to have been written, with many little comments from a Kilroy-type character and with some slightly silly remarks here and there.

However, this book does give much help in learning TRS-80 Basic than Radio Shack's Level II manual, which is

actually a reference manual, and, with its many examples and questions, offers about as thorough a grounding as David Lien's excellent book, *Learning Level II.*

The Albrecht-Inman-Zamora book is available from Radio Shack, with a new cover and title, *TRS-80 Level II Basic,* for $9.95.

* * *

The S-100 Bus Handbook, by Dave Bursky. Hayden Book Company, Inc., Rochelle Park, NJ. 264 pages, paperback $12.95. 1980.

Although this large paperback contains a great deal of information about the S-100 bus and the boards designed to operate on that bus, the lean meat is concentrated in three chapters and 54 pages in the middle of the book.

These three chapters are on Input/Output Interfaces for the S-100 Bus, Peripheral Storage Devices for Microcomputer Systems, and Interfacing the Microcomputer to Real-World Applications.

The rest is either too compressed for most readers, or too sketchy to be useful, or filler.

The first five chapters are a mixture of too-fast and sketchy. The first chapter, an introduction, goes through the history of computers, what's in a computer, and what's a microprocessor, in 9½ pages, of which over 4½ pages are photos and drawings.

Chapter 2, on binary and Boolean, is all of six pages long. Chapter 3, on electronics and logic functions, squeezes transistors, ICs, gates and flip-flops into 16 pages, of which over 8 pages are photos and drawings, many of which add little to the text.

Chapter 4, on the basic S-100 bus, describes what each pin does, the use of control and signal lines, and has one page on how the CPU works. The chapter on memory, like Chapter 4, contains some good material, but also contains much filler, such as a page of pinouts for several processors.

The big filler is Appendix C, 90 pages of schematics of 31 commonly used S-100 bus boards. The chapter on troubleshooting is mostly about error messages.

Those three chapters are pretty good, but $12.95 is a lot to pay for 54 good pages out of 264.

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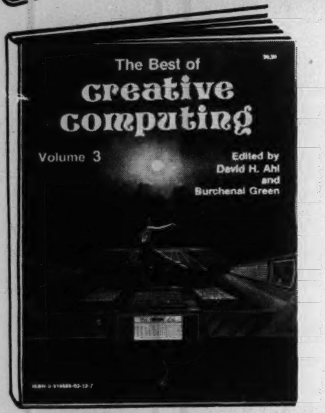

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A sample of the diverse contents is listed.

Edited by David Ahl and Burchenal Green. Large format. 336 pages. $8.95 (12C).

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The Programmer's Book of Rules, by George Ledin Jr. & Victor Ledin. Lifetime Learning Publications, div. of Wadsworth Publishing Co., 10 Davis Dr., Belmont, CA 94002. 256 pages, paperback $7.95. 1979.

PBR, as the back cover nicknames this book, is a digest of 272 "essential" rules, grouped into 15 chapters. According to the publisher, it covers: knowing the client's needs and solving their problems, choosing the right language for their job, program layout and displaying program output, step-by-step program procedures, encoding and debugging procedures, evaluating the program's performance, and references to latest literature by leading authorities.

The 15 chapters are grouped into three parts. Part I, Do It For Your Client, consists of one chapter, on Know your clients' needs, and includes rules such as "aim your program at the widest circle of users," sub-rules such as "write as general a program as possible," and sub-sub-rules such as "avoid writing programs that serve only single needs or solve single problems."

Part II, Do It With Style, has four chapters, on Solve the problem, Know your programming language, Make your program layout readable, and Make your output meaningful and useful.

Part III, Do It With Substance, has ten chapters, on Proceed step by step, Use decision and repetition structures, Split your program into subprograms, Be careful with variables and expressions, Avoid indiscriminate jumps, Code and debug your program, Test and edit your program, Utilize software tools, Evaluate your program's performance, and Annotate and document your program.

Examples of programming in Basic, Fortran and Cobol, plus many references and a lengthy bibliography make this a highly useful text for any programmer, even if he remembers only a tenth of the rules.

* * *

The Computer Age: A Twenty-Year View, edited by Michael L. Dertouzos and Joel Moses. MIT Press, Cambridge, MA. 507 pages, hardcover $25. 1979.

This look into the next 20 years of computer development and the potential impact consists of contributions by 20 computer authorities such as Terry Winograd, who wrote about "convivial computing," Seymour Papert (computers and learning), J.C.R. Licklider (computers and government), Daniel Bell (the social framework of the information society), Roger Noll (regulation and computer services), Robert Noyce (hardware prospects and limitations), Alan Perlis (current research frontiers in computer science), Joseph Weizenbaum (the computer revolution), etc.

"Written for the serious layperson as well as for the professional," the book is divided into five parts: Prospects for the Individual (Winograd, Papert, Licklider, etc.), Trends in Traditional Computer Uses (business and scientific), Socioeconomic Effects and Expectations (Bell, Noll, etc.), Trends in the Underlying Technologies (Noyce, Perlis, etc.), and Critiques (Weizenbaum and two replies to his piece).

The book starts with The Computer in The Home, by one of the editors, Moses, who presents current and future glimpses of home computing, and discusses the issues of privacy and government regulation. Computer art is discussed in The Return of the Sunday Painter.

Authors discuss automation, conferences, learning, information services, modelling, economics, sophisticated software, and a dozen other subjects in a language easily understood by anybody interested in getting a wide perspective on the world of computing. This is the best general book I've seen so far on the subject.

The Most Popular Subroutines in Basic, by Ken Tracton. Tab Books, Blue Ridge Summit, PA. 182 pages, paperback $5.95. 1980.

The front cover calls this "A programmer's manual to the most useful and versatile Basic subroutines and how to use them." Most useful, perhaps, to someone working for the National Bureau of Standards, but not for the average computer user, either mainframe or personal.

How often does the average person, or even most specialists, need to compute the future value of an annuity, convert from fluid ounces to milliliters, convert from radians to grads, calculate series capacitance, calculate the rectangular moment of inertia, add vectors, or plot the trajectory of a projectile?

This is a book to put on your reference shelf, for the rare moment when you might need one of these subroutines. However, most of us might need the book only once a year at the most, and most of the subroutines are so simple that they can be worked up on the spot from memory.

For instance, there are 57 pages of conversion routines, every one based on a single programming line, such as LET J=2055*B or LET L=3.785*G. The chapter is padded out with lengthy test runs, but could be condensed to two or three pages.

Some specialists may find a few of these subroutines useful, as in the mathematics or physics sections, but again, most of these are so simple that most of us could write the line or two of required programming from memory in less time than it takes to look them up in this book. All we need is the conversion factor or the formula, most of which in this book are very simple.

* * *

Weighting For Baudot and other problems for you and your computer, by F.D. Federighi and E.D. Reilly Jr. Avery Publishing Group Inc., 89 Baldwin Terrace, Wayne, NJ 07470. 249 pages, paperback $9.95. 1978.

The authors, who teach courses in computer science at the State University of New York at Albany, wrote this book of 240 problems to "allow students taking introductory computer courses to make their own choices from a wide problem selection," as well as for other reasons that include organizing a problem-solving seminar, and for solving "problems of interest just for fun on your microcomputer."

The problems are divided into 12 sections of increasingly difficult tasks, from a 1-point problem involving counting the number of parentheses in a text, to a 5-point problem that asks the reader to check a file for duplicate names and addresses, to a 20-point problem that requires "creating, maintaining, and interrogating a small single-thread relational database."

The book provides a great variety of problems, all language and computer independent, each described in detail and written quite simply, although the simplicity is relative, especially in problems involving higher math.

No solutions are provided; the preface ends with "May a happy camel bring you a bag of fortune cookies containing solutions for all your problems." The far-out (far-inside?) title is in the same vein.

"A goodly amount of cross-referencing between problems" is found. The authors "hope the student will enjoy exploring these byways and, as we did, learn something in the process."

The problems involve everything from baseball to Roman numerals, and are recommended to anybody looking for several hundred challenges.

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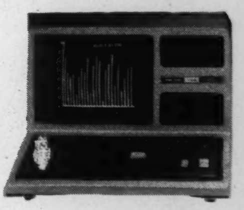

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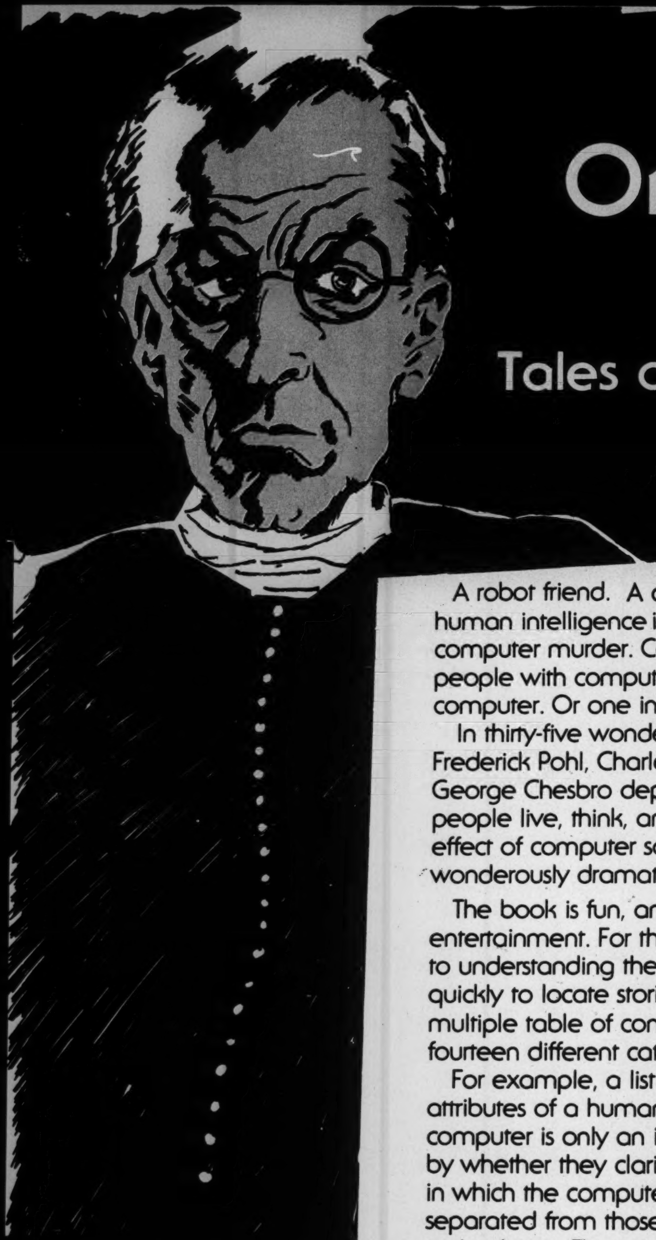

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The book is fun, and will provide wonderful hours of entertainment. For the reader interested in a structured approach to understanding the potential roles of the computer, or wanting quickly to locate stories that support or challenge his viewpoint, a multiple table of contents is provided. This lists the stories in fourteen different categories.

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Z-80 Microcomputer Design Projects, by William Barden Jr. Howard W. Sams & Co. Inc., Indianapolis, IN. 208 pages, paperback $12.95. 1980.

The title is slightly misleading, because the entire book is about the theory, construction and use of a Z-80-based computer called the EZ-80.

This may be the only book published in 1980 on how to build a computer, and as such should be of great interest to anybody (assuming there are still such people in these days of proliferating off-the-shelf personal computers) who wants to do so from scratch.

A complete set of parts to build the Z-80 "may be purchased for about $50," according to the preface. The EZ-80 consists of five parts: power supply, keyboard, microcomputer board, "applications area," and optional large-digit display. The applications area is for additional hardware such as a relay for the telephone-dialer project, or a resistor network, amplifier chip and speaker for the music-synthesizer project, etc.

The list of parts includes ten ICs, LED display, 14 sockets, a dozen resistors and capacitors, power-supply parts, slope-front chassis, and a 4-by-8-inch perfboard for constructing, via wire-wrapping, the EZ-80 microcomputer board.

Complete and detailed construction details are given, including wire-wrap lists, a chapter on programming the EPROM that tells how to build an EPROM programmer, and a diagnostic program to check out the EZ-80 when completed. Artwork is given for a PC board.

Even a beginner should have little trouble, what with six chapters on theory. Projects include a burglar alarm, timer, and frequency counter, in complete detail. This is a fine book for the do-it-yourselfer.

* * *

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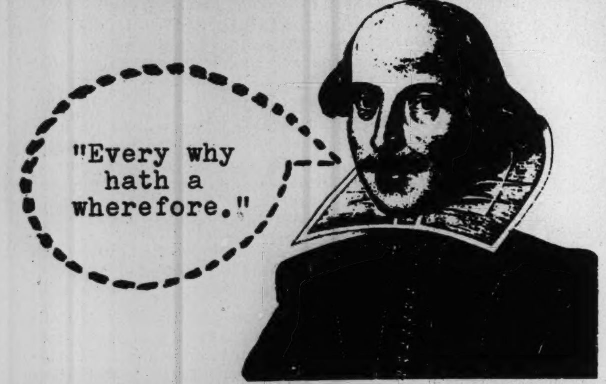

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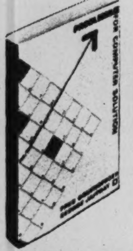

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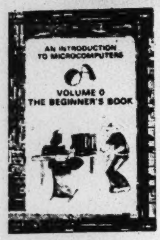

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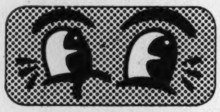

Microprocessors: From Chips to Systems

Rodnay Zaks. A complete and detailed introduction to microprocessors and microcomputer systems. Some of the topics presented are: a comparative evaluation of all major microprocessors, a journey inside a microprocessor chip, how to assemble a system, applications, interfacing (including the S-100 bus) and programming and system development. 416 pp. $9.95 [10S]

The First Book of Microcomputers

Robert Moody. Tells what personal computers are and what you can do with them in a light entertaining style. Starts with the basics and then covers the technical aspects such as how a personal computer is constructed and how it works. Includes such things as home protection, keeping track of budgets and bills, game playing, inventory management and tax calculations. 139 pp. $5.35 [10T]

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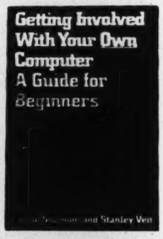

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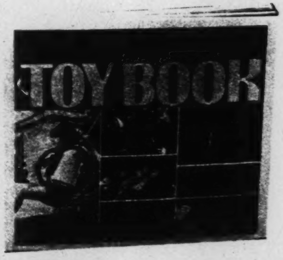

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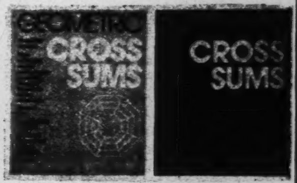

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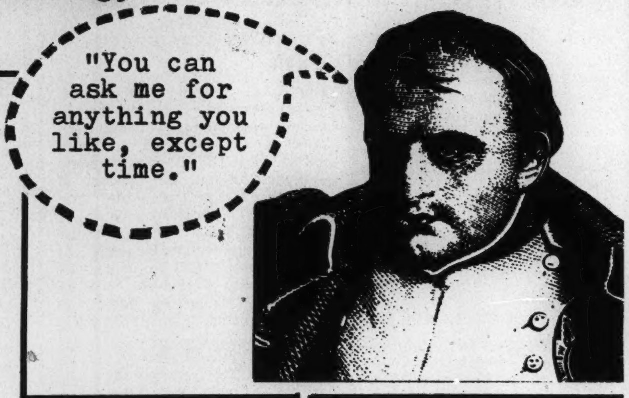
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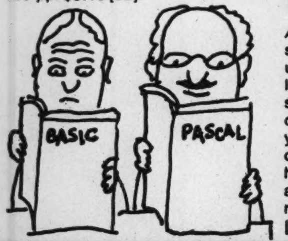

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Albrecht, Finkel, & Brown. This book shows you how to read, write, and understand the BASIC programming language used in the new personal-size microcomputers. Includes detailed descriptions of everything you need to know to make your computer work for you—includes how to get started, numerous applications and games, lists of resources, much more. 332 pp. $8.95 [7G]

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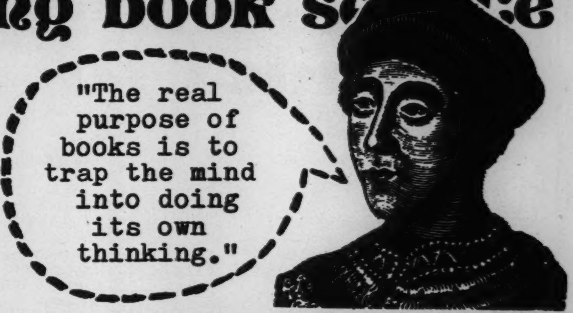
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Puzzle Answers

The School Days Puzzle: In each case the letters in the series are the first letter of a series of words. In problem one we have *T*en, *N*ine, *E*ight, *S*even, *S*ix . . . the answer here would be *F*ive, *F*our, *T*hree, *T*wo, *O*ne. In problem two we have the days of the week backwards; *S*aturday, *F*riday, *T*hursday, *W*ednesday, *T*uesday, . . . the answer here would be *M*onday and *S*unday. In problem three we have the months of the year backwards and the answer would be: D,N,O,S,A,J,J,M,A,M,F,J.

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1) 11-9
2) 7-11
3) 4-7
4) 9-4
5) 10-9
6) 8-10
7) 6-8
8) 9-6
9) 12-9
10) 15-12
11) 11-15
12) 7-11
13) 9-7
14) 14-9
15) 16-14
16) 10-16
17) 8-10
18) 5-8
19) 7-5
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40) 10-12
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